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Obstruction of sixteen inches of ileum by an unchewed and undigested conglomeration of peas and beans with tapeworms. (See p. 235.) *Frontispiece.*



INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIAT-
RICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,
OTOLOGY, RHINOLOGY, LARYNGOLOGY,
HYGIENE, AND OTHER TOPICS OF INTEREST
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

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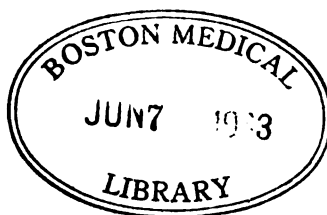
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Diagnosis and Treatment

THE VACCINE TREATMENT OF TYPHOID FEVER— REPORT OF A SERIES OF EIGHTEEN CASES

BY EDWARD H. GOODMAN, M.D.

Associate in Medicine, University of Pennsylvania

THERE can be no doubt that vaccines have an assured value in the prevention of typhoid fever. No better proof of this statement can be offered than the publications of the English, German, and United States Governments, quoted by Russell in his address before the Harvey Society of New York (*Am. J. Med. Sc.*, 1913, cxlvi, 803). In this country, the prophylactic was first used in the United States Army in 1909, the inoculation being performed with volunteers. Approximately 20,000 men were vaccinated, and, although accurate statistics are not available, the result of the injection was so striking that it was urged by army surgeons to make the prophylactic inoculation compulsory.

This request, which was made a command in 1911, was in part based on the experience of the United States army in 1898. "In this war the mortality from typhoid fever was 86.24 per cent. of the total. The morbidity was 192.65 per thousand of mean strength, or a little less than one-fifth. The mortality per thousand of mean strength was 14.63" (Russell). It was to prevent a recurrence of the horrid conditions existing in the United States army during the Spanish-American War that all troops along the Mexican border ("the manœuvre division") were vaccinated.

The result of the vaccination in the San Antonio camp, the largest of the manœuvre camps, as compared with the Jacksonville camp in 1898, may be learned from the table from Russell's article.

1898, Spanish-American War, Jacksonville, Florida—Number of troops, 10,759; cases of typhoid certain, 1729; probable, 2693; deaths from typhoid, 248; all deaths, 281. 1911, Camp at San An-

tonio—Number of troops, 12,801; cases of typhoid certain, 2; all deaths, 11.

To date, about 200,000 men in the army and navy have been vaccinated without a single fatality or serious complication. The duration of immunity conferred is about two and a half to three years (English army), although Russell has no definite conclusions based on his own work. Should one feel skeptical about the success of anti-typhosis vaccination, he has but to read Major Russell's admirable address, where convincing statistics are offered in great number.

The brilliant results obtained in the armies of the larger countries of the world have led physicians to recommend vaccination to the general public, especially to those who travel or whose occupation brings them in contact with the sick, or who live in industrial centres, lumber camps, engineering camps, or who comprise the large body of individuals known as pleasure-seekers.

Although there can be no doubt regarding the prophylactic use of typhoid vaccines, their employment as a therapeutic measure has not been so generally and favorably regarded. The theory on which therapeutic use of vaccines is urged is, first, the fact that typhoid fever does not call into action all the immunizing capacities of the uninfected tissues; and, secondly, that subcutaneous tissue, following hypodermic injections of vaccine, produces antibodies in large amounts, and affords a reserve supply hitherto untapped to the organism. Vaccine therapy has for its object, then, the stimulation of the immunizing properties of uninfected tissue, so that more antibodies are produced than are ordinarily manufactured in the course of the natural infection. It is hoped, therefore, that a combination of the naturally and artificially induced antibodies will prove of value in lessening the duration of the disease, or, at least, in making the infection less formidable.

The first serious attempt to influence the disease by what may be called specific treatment was made by Chantemesse (*Internationaler Kongress f. Hygiene und Demographie*, 1907, i, 195) in 1902. The material used was a toxin obtained by growing typhoid bacilli in splenic pulp, followed by inoculation into horses. The serum obtained from these animals was used for injection. Chantemesse estimates the mortality in the Paris hospitals from April, 1901, to July, 1907, as being 17 per cent., and compares this mortality with 1000 cases

treated by him with his serum during the same period of time with a mortality of 4.3 per cent. Brunon and Josias have been equally fortunate. With the serum, Chantemesse has noted usually an immediate rise of temperature followed by a rapid fall to normal, this fall extending over several days. There is an almost immediate change in the patient's appearance, the pulse becomes slower and there is an increased amount of urine. Complications seem to be rarely encountered. This serum, believed by Wright to be a bacterial vaccine and not a serum in the true sense, although so extolled by Chantemesse, seems to have been little used by other clinicians.

In 1909, Smallman first attempted the use of vaccines in the treatment of typhoid fever (*Jour. Royal Army Med. Corps*, 1909, xii, 136), following the suggestion of Leishman. Thirty-six cases were treated, the dose at first being 100 M. (100,000,000), and injections were repeated at intervals of nine or ten days. Subsequently the dosage was gradually increased to 250–350 M. and the intervals shortened (6 days), with much better effect. Leishman endorses the enthusiasm which Smallman has for the method, and predicts a brilliant future for the vaccine treatment.

Since the paper by Smallman, there have been numerous articles commending in no uncertain words the great benefit of specific therapy. Callison (*Med. Rec.*, 1911, lxxix, 1129), in 1911, collected all references to the subject, and found 323 reputed cases, with 20 relapses and 17 deaths (mortality of 5.2 per cent.). He believes injections of vaccine prevent relapses and lessen complications, and in some cases shorten the original attack. Stock vaccines are preferable to autogenous vaccines, and prompt use of these is urged so soon as the diagnosis is made.

A later paper by Callison (*Am. Jour. Med. Sc.*, 1912, cxliv, 350) records the treatment of 38 cases with five deaths, one relapse, and with an unusual absence of complications (mortality 13.1 per cent.). He has continued the collection of cases from literature, and has amassed a total of 475 cases treated with vaccines. The mortality of these has been 6.5 per cent., and relapses have occurred in 6.5 per cent. of the cases. Callison prefers to omit 52 cases of Sadler (*Quart. Jour. of Med.*, 1911, v, 193), as the dose used was absurdly small—1 M. and 2 M. By this procedure we have 423 cases so far reported, with a mortality of 5.4 per cent. and a relapse incidence of 6.5 per

cent. Contrasting this with a death rate of 16 per cent. in certain New York hospitals, Callison believes the future of the treatment is most promising. He urges early use of the vaccine before the patient is exhausted and before complications intervene.

Callison's charts show a decided change in the temperature curve at a time corresponding to the production of opsonins and agglutinins. This change is so constant in the cases treated with vaccines that it is believed to be more than coincidental. The patients at this time lose the "typhoid facies," appear bright, and take an interest in their surroundings. The appetite improves and they sleep better.

Watters (*Med. Rec.*, 1913, Sept. 20) has supplemented this paper of Callison's by a series of 1120 cases, obtained in part by a general letter sent to internists, and in part from the literature. In this series 57 deaths are reported on a percentage mortality of five. It is difficult to judge of this mortality record, as the mortality of typhoid fever is quite variable, and although the mortality is low, it is scarcely lower than that of some institutions (5 to 6 per cent.).

There has been raised the issue whether vaccine treatment is associated with any danger to the patient: this uncertainty has, no doubt, been augmented by the dread of the negative phase,—the phase following inoculation when resistance is much lowered and when, for a time, infection is most likely to result. In Wright's "Studies on Immunization," he no longer emphasizes this danger, and even approves of the therapeutic use of antityphoid vaccine, a position which would have been absurd if vaccination lowered the patient's resistance to typhoid toxins. If the negative phase exists in typhoid fever, it is negligible, and it may be assumed that, given in rational doses, the vaccine treatment is without danger.

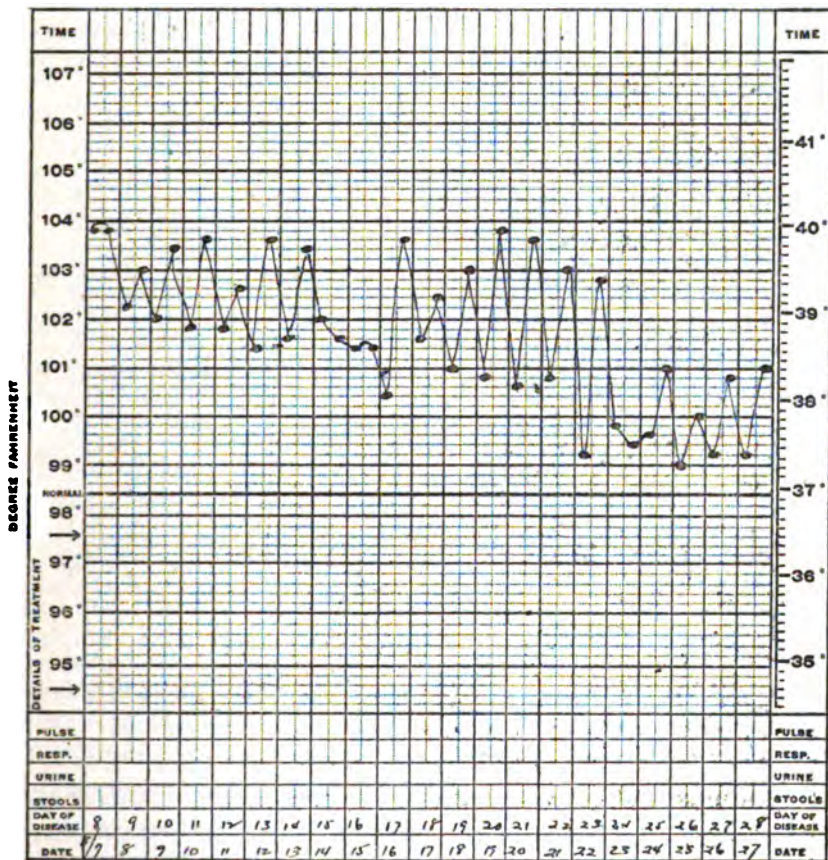
Although many papers have been written concerning the vaccine treatment, I have no hesitancy in offering my series of eighteen cases observed during the past year in the Presbyterian and Philadelphia Hospitals, on the service of my chiefs, Dr. James E. Talley and Dr. H. B. Allyn. Fortunately, typhoid fever is a rare disease in Philadelphia, but this year there was a distressing outbreak, so that the number of my cases is fairly large in comparison to cases seen in recent years.

CASE I.—Presbyterian Hospital. William C., aged 26, admitted August 7, 1913, discharged October 6, 1913. Two weeks ago had headache, and two days

later had a chill which reappeared every two days until a week ago. August 7, 1913, blood culture negative for typhoid. August 13, 1913, Widal negative for alpha paratyphoid; positive for beta paratyphoid. August 18, 1913, Widal positive for typhoid.

The use of bacterins in this case was begun very late in the disease,

FIG. 1.



Temperature chart. Case I.

at least the fourth week. It is, of course, impossible to say how much good the vaccines did, but they at least did no harm. Result, cured. No complications; no relapse.

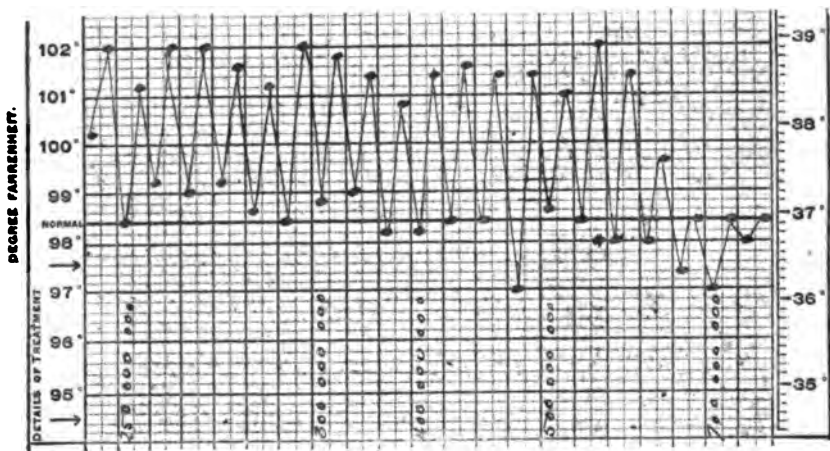
CASE II.—Presbyterian Hospital. John W., aged 20, admitted August 17, 1913, discharged October 8, 1913. One week ago began to feel ill. Loss of appetite,

constipation, weakness, fever. August 17, 1913, Widal positive. Blood culture negative. On September 1, 1913, three furuncles developed on the back.

Bacterins were first used on the sixteenth day, and through an oversight were not given until the ninth day following. Result, cured; complications, furunculosis; relapse, none.

CASE III.—Presbyterian Hospital. Nathan B., aged 48, admitted August 30, 1913; died October 4, 1913. Began to feel ill three weeks ago; nothing definite. One week ago had severe headache, loss of appetite, fever, pain in epigastrium, epistaxis, and constipation. September 1, 1913, Widal suggestive; blood culture negative. September 4, 1913, Widal suggestive.

FIG. 2.



Temperature chart. Case I.

Vaccines used on the thirteenth day of illness. During the course of the infection, patient had bronchitis and occasional attacks of vomiting. On October 4, 1913, patient's abdomen suddenly became tympanitic—no pain, no dulness in the flanks. There was no sign of perforation, and patient died a few hours after onset of symptoms.

The patient had been a peddler and was much debilitated by hard work and exposure, but was in fair condition on admission to the hospital. Result, death; complications, bronchitis, vomiting.

CASE IV.—Presbyterian Hospital. Samuel C., aged 20, colored, admitted September 14, 1913; discharged November 26, 1913. Two weeks ago noticed headache, which lasted for half a day only. This time had soreness in stomach and began to feel tired and sleepy. Since then he has had occasional headaches, and five days ago had a chill, high fever, and loss of appetite. Five days ago he

went to bed. Bowels constipated, some vomiting, cough, expectoration. September 14, 1913, blood culture negative. September 18, 1913, Widal negative. September 16, 1913, sputum negative for *B. tuberculosis*. September 19, 1913, paratyphoid alpha positive; Widal paratyphoid beta negative. September 20, 1913, Wassermann negative. October 6, 1913, spinal fluid negative.

On the 20th of September, 250 M. stock vaccine were given, just before the report of the alpha paratyphoid agglutinins was received. An attempt was made to secure a paratyphoid vaccine, but was unsuccessful. On October 1st, the patient was markedly worse. There was frank subsultus tendinum, the arms were flexed, the neck was rigid, and a positive Kernig's sign, with exaggeration of the bicipital and patellar reflexes. A lumbar puncture was made about this time, and the fluid seemed to be under pressure. On October 10th, the patient was worse, and had at times a low muttering delirium. On October 15th, 400 M. stock typhoid vaccine were given, and from this time on the patient seemed to improve. He had all the appearance of a case of true meningitis, and his condition was most critical at the height of the infection. Result, cured; complications, bronchitis, meningismus (meningitis?).

In the absence of a positive blood culture and Widal for typhoid fever, and in the presence of a positive agglutination test for paratyphoid fever, the latter diagnosis seems plausible even though no culture was obtained from the blood.

CASE V.—Presbyterian Hospital. Charles J., aged 16, admitted August 1, 1913, discharged October 6, 1913. Five days ago had dull pain in abdomen which lasted four days. On the day before admission, the pain was attended by nausea, but the patient could not vomit. Appetite poor, bowels regular until five days ago, and since then, following a purge, he has had excessive diarrhoea. On admission, patient did not complain of pain in the stomach. August 3, 1913, Widal positive.

Vaccines were given on the thirtieth day of the disease; and, since then, the patient's general condition has improved. Result, cured; complications, none; relapse, none.

CASE VI.—Presbyterian Hospital. Charles C., aged 37, admitted July 14, 1913, discharged October 11, 1913. On admission, complained of weakness, headache and backache. He has not felt well for a month, and nine days ago had to stop work on account of weakness.

On the twenty-eighth of July, furuncles appeared on back. On August 11th, an autogenous vaccine (100 M.) *Staphylococcus aureus*

was given. This was repeated at intervals of 3 days in increasing amounts until the 22d of August, when the furuncles had almost entirely disappeared.

The temperature continued to remain high even on the forty-third day of the disease. Although it was believed that at that period vaccines would have but little effect, nevertheless 250 M. typhoid organisms were given. The patient at this time was in a very critical condition, emaciation was marked, and there was extreme weakness. His weight had fallen from 116 to 89 pounds.

The effect of the vaccines could be well seen, as there was an immediate tendency of the fever to fall, and this was followed by a rise and continued fever. We felt at this time that the patient's weakened condition was a contra-indication either to large doses of the bacterin or to frequent repetition of smaller amounts. Hence, a second injection was delayed until the tenth day, when 300 M. were injected. We feel now that our timidity was ill founded, and we would not hesitate to administer the vaccines in a similar case. Following the use of 300 M. there was a marked improvement and the temperature returned to normal. July 20, 1913, blood culture positive; stools, no occult blood. July 26, 1913, stools, occult blood present. July 31, 1913, occult blood absent. August 13, 1913, Widal paratyphoid alpha negative; Widal paratyphoid beta negative. Result, cured; complications, none; relapse, none.

CASE VII.—Presbyterian Hospital. Dan T., aged 17, admitted July 26, 1913, discharged October 7, 1913. On admission, complained of dull headaches and soreness in the abdomen. The patient's illness began three weeks ago with weakness, headache, and loss of appetite. The symptoms have gradually increased in intensity.

On August 9th, furuncles appeared on the back and chest. Two days previously the patient had had a profuse intestinal hemorrhage. On August 11th, there were two hemorrhages, after which he felt very well. On August 16th, the temperature became higher and remained so until a relapse on the 29th, when 250 M. typhoid bacilli were given. From the time of the first injection the temperature became lower, and the patient began to improve. July 26, 1913, Widal positive. August 4, 1913, blood culture negative. August 13, 1913, Widal paratyphoid alpha negative; Widal paratyphoid beta negative. Result, cured; complications, none; relapse, none.

CASE VIII.—Presbyterian Hospital. George K., aged 23, admitted September 15, 1913, discharged October 20, 1913. Chief complaint, headache and tired feeling. He had felt well until eight days ago, when he became drowsy and tired. Five days ago there were fever and a headache.

The patient seemed to feel perfectly well after coming to hospital and had no objective symptoms. Thinking he was not ill enough to require bacterin treatment, none was begun until September 25th, when the persistence of a low-grade fever induced us to administer 500 M. This had the effect of lowering the fever, and a second injection of 750 M. resulted in a return of the temperature to normal, and after this there was no further rise. September 15, 1913, Widal positive; blood culture negative. September 19, 1913, Widal paratyphoid negative. Result, cured; complications, none; relapse, none.

CASE IX.—Presbyterian Hospital. William E., aged 23, admitted October 4, 1913, discharged December 6, 1913. About three weeks ago the patient was nursing a friend who had typhoid fever, and since then has had headache, lassitude, and depression. His condition has become worse, until night before admission, when he had a chill and fever. The bowels have been constipated and there was nausea.

On the second day after admission, the patient was given 250 M. organisms, and this dose was repeated at intervals. The temperature curve was favorably influenced, and remained normal for ten days, when a relapse took place, without any noticeable change in the patient's good condition. A blood culture taken at the time of the relapse was negative. October 5, 1913, Widal positive. October 16, 1913, blood culture negative. November 5, 1913, blood culture negative (relapse). Result, cured; complications, none; relapse, one.

CASE X.—Presbyterian Hospital. Lowry S., aged 26, admitted October 6, 1913, discharged December 3, 1913. The patient began to feel ill about three weeks ago, and was drowsy, weak, and tired, and had headache. Ten days ago he had to go to bed. At this time there were fever, nausea, and vomiting.

Vaccines were injected on the second day after admission. On October 10th, the alpha paratyphoid test was strongly positive. We tried to get a blood culture, but the report was returned: "Bacillus with morphology of *B. typhosus* does not agglutinate with typhoid serum." A stock of the alpha and the beta paratyphoid bacillus was ordered but was not obtained until late in the disease (thirty-ninth day). In the meantime typhoid vaccines had been injected, but did not influence the temperature. On the 3d of November, 250 M.

paratyphoid were used, and caused an almost immediate fall to normal. October 6, 1913, Widal typhoid negative. October 9, 1913, alpha paratyphoid positive. October 16, 1913, blood culture typhoid negative; paratyphoid infection. Result, cured; complications, none; relapse, none.

CASE XI.—Presbyterian Hospital. William L., aged 31, admitted October 4, 1913, discharged November 26, 1913. Two weeks ago the patient had to go to bed on account of nausea and anorexia. He had fever on the fourth day, and since then has gradually become worse. October 5, 1913, Widal negative. October 12, 1913, Widal typhoid positive; paratyphoid beta positive; paratyphoid alpha suggestive.

Result, cured; complications, none; relapse, none.

CASE XII.—Presbyterian Hospital. John M., aged 19, admitted December 4, 1913, discharged February 8, 1914. The patient's illness began November 29, 1913, with fever, nausea, vomiting, and malaise. He went to bed and since then became worse until admission.

Stock vaccines were given at once, and were continued until November 18th, when an autogenous vaccine was first used. In this case, there seemed to be little effect on the temperature and on the course of the disease. After giving 1000 M. on the 4th of January, the dose was not increased, but this amount was used for subsequent injection. December 5, 1913, Widal negative; blood culture positive. January 4, 1914, no plasmodium malariae. Result, cured; complications, none; relapse, none.

CASE XIII.—Presbyterian Hospital. David Q., aged 33, admitted October 8, 1913, discharged November 2, 1913. About the middle of September the patient began to feel tired, heavy, and drowsy, and complained of gastric oppression and anorexia. These symptoms continued for about two weeks, when he began to have fever, with aggravation of symptoms. The bowels moved every third day.

The patient was not very ill on admission, but rose spots, palpable spleen, and a suggestive Widal, in conjunction with the past history, led to the use of the vaccines. Only one injection was made, since the temperature soon fell to normal, where it remained until time of discharge. October 9, 1913, Widal—some clumping and lessened motility. October 17, 1913, Widal paratyphoid alpha negative; Widal paratyphoid beta negative. Result, cured; complications, none; relapse, none.

CASE XIV.—Presbyterian Hospital. George S., aged 25, admitted October 20, 1913, died October 29, 1913. The patient was admitted to the ward suffering

with generalized abdominal pain, especially in the right iliac region. Seven days ago he began to have pain in abdomen and in the back. He kept at his work, but five days ago was forced to go to bed on account of giddiness and general malaise. During the next four days he became gradually worse, and the pain in the back and abdomen more severe and finally continuous.

At first, we were in doubt whether we had to do with a case of typhoid fever or of appendicitis, as there was marked tenderness over the entire abdomen, especially in the right iliac region. October 21, 1913, Widal suggestive; blood culture positive (this report was not obtained until after the perforation occurred). On the second day after admission, 250 M. organisms were injected. On October 26, 1913, the patient presented signs of perforation. Operation was performed fifteen hours after the onset of the initial symptoms, and the patient died two days later. Result, death; complications, perforation; relapse, none.

CASE XV.—Presbyterian Hospital. Ira D., age not stated, admitted December 5, 1913, died December 13, 1913. On admission, suffered with fever and malaise. The illness began about a week ago with fever, anorexia and malaise; since then his condition has grown worse, and he walked into the examining room to find out what the trouble was.

The day after admission, the patient became delirious. After the second injection he was not quite so delirious and looked brighter. On December 9, 1913, there was profuse hemorrhage from the bowel. Death occurred on the sixteenth day of the illness. December 5, 1913, Widal positive; blood culture negative. Result, death; complications, hemorrhage.

CASE XVI.—Philadelphia Hospital. Charles W., aged 17, admitted September 29, 1913; discharged December 19, 1913. On admission the patient complained of headaches and of pain in the abdomen. His illness began five days before admission. The bowels were regular.

Following the first injection on October 9, 1913, the maximum degree of fever was reached, and from that time on the temperature declined, and improvement progressed steadily. Result, cured; complications, none; relapse, none.

CASE XVII.—Philadelphia Hospital. Paul U., aged 47, admitted October 5, 1913, discharged November 12, 1913. On admission, the patient complained of pain in the abdomen. He is a Hungarian and no history could be obtained. Later it was learned that he had been ill for about five days, having been taken sick on the boat after leaving Hamburg.

Result, cured; complications, none; relapse, none.

CASE XVIII.—Philadelphia Hospital. John F., aged 25, admitted December 13, 1913, discharged February 12, 1914. The patient could not speak English, and no information could be obtained concerning the duration of his illness.

Result, cured; complications, none; relapse, none.

RESULTS

Total cases, 18; cured, 15, or 83.3 per cent.; died, 3, or 16.6 per cent.; relapse, 1, or 5.5 per cent.; complications, 3, or 16.6 per cent.

In comparison with these figures, I quote the cases seen in the hospital in 1903 and 1904 during a particularly severe epidemic, before vaccines came into general use:

Total, 59 cases; cured, 49, or 83.0 per cent.; died, 10, or 16.9 per cent.; relapse, 2, or 3.3 per cent.; complications, 21, or 35.5 per cent.

Both series are too small to be of much value, but there is a decided resemblance between the two except in the percentage of complications. A point open to criticism in my cases is the fact that bacterins were not begun uniformly early. This is admitted.

From these few cases one can form no conclusion, but he may be permitted to record impressions derived from his own experience and from that of others.

CONCLUSIONS

1. The basis for vaccine therapy in typhoid fever is sound.
2. To be of practical use early diagnosis is important.
3. The initial dose should be 250 M., increased to 400 M. on the fourth day, and 100 M. every fourth day thereafter.
4. Ten days after defervescence, a final injection should be given, the amount to be that of the preceding injection.
5. Inoculation seems to be beneficial in some cases; in none is it harmful.
6. In a large series the mortality is reduced to 4.9 per cent., and there is a reduction in complications and relapses.
7. The number of cases hitherto reported in the literature is too small to estimate the value of vaccine therapy, although it gives promise of reducing typhoid mortality to a point heretofore unattained.

TREATMENT OF DIPHTHERIA

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HAVING made your diagnosis of diphtheria, you arrange your sick-room for the siege that is in prospect and decide about the nurse. If you can have a trained nurse, so much the better; but as few families can afford this luxury for several weeks, more often you cannot, so you have to take what your patient's family can give you, which is most often a member of the family, and the member who is the usual choice is that finest creation of the universe—the mother. She is a heroine, also, let me remind you, for in this disease it is not at all infrequent for the nurse or the doctor, or even both, to contract the disease, and the greatest danger lies with the inexperienced nurse who does not know the best methods of self-protection, and who is liable to be overlooked by the doctor in his anxiety for his patient.

The sick-room in this disease should be like the sick-room in practically any disease—the best room in the house. It should be sunny, well-aired, easily warmed, cool, cheerful, and as far away from noise and excitement of the house or outside as is possible. From it should be removed everything not actually needed in the care of the patient. This includes hangings, draperies, curtains, carpets, rugs, pictures, furnishings of all kinds, etc.

If possible, an ordinary iron hospital cot bed should be used in the sick-room. It facilitates the handling of the patient, is easily moved about for cleaning purposes, and is easier to disinfect and clean after the illness is over. All the bedding used on it should be such that the family will not object to its being destroyed after the illness is over, or as will stand a most thorough disinfection. The bed linen should at all times be kept clean, no matter how often this means changing it. All the bed linen, if unstained by blood or other discharges, should be transferred immediately on removal from the bed to another unused

sheet which is wrapped around the things and the entire bundle then immediately boiled. This means being kept in boiling water for at least thirty minutes after the water has been brought to the boiling point. With stained bedding or bed linen a preliminary soaking in a cold antiseptic solution is preferable, as blood stains particularly wash out easier in cold water. All bed clothing used by the patient should receive the same care given to the bed linen.

The use of paper handkerchiefs, which can be immediately burned, is to be highly recommended for use in the sick-room by both patient and nurse. Nasal and buccal discharges of any kind from the patient not attended to in this way are to be received into vessels which contain strong antiseptic solutions and which are to be kept covered when not in use.

The urine contains the bacilli in many cases and, therefore, both the stools from the patient and the urine passed separately should receive a most thorough disinfection with carbolic acid solution, chloride of lime, or other antiseptic before being finally disposed of by the attendant. This may seem to you a good deal of unnecessary trouble, but it is absolutely necessary for the protection of the family and the public at large.

Your sick-room must be kept clean and yet no dust must be raised. In fact, any cleaning or sweeping wherein dust is raised is a great waste of time and energy. What is the use of sweeping or dusting dirt from one place to put it in another? In the sick-room, cloths which have been moistened with a strong antiseptic solution are used on the walls, woodwork, floor, etc., daily. These cloths should then be burned, or, if they are to be used again, they must be thoroughly boiled before being laid aside until the morrow.

Your patient, likewise, must be kept very clean, and where the baths are contra-indicated, a daily sponge and alcohol rub are very acceptable. Of course, towels, wash cloths, sponges, etc., should receive the proper care, as mentioned above, in regard to other things used in and about the patient.

Anything that is used to clean out the mouth or nose of the patient should be burnable, and that is what should happen immediately after its use. It is a very good idea to have a number of paper bags handy to the sick-room to be used one at a time to put soiled material into, and then this bag is closed in some way or sealed and thrown into the fire.

The nurse, when in the room, wears a cap, which covers her head except her face, and a close-fitting gown of washable material, which permits her hands only to be exposed. This gown should be somewhat shorter than the usual dress, so as to be several inches clear of the floor. She never leaves the room without thoroughly washing her hands in an antiseptic solution, wiping off her face with a cloth which is moistened with an antiseptic, and washing out her mouth with a suitable antiseptic solution. She sheds her cap and gown just within the sick-room, leaving them near enough to the doorway to enable her to slip back into them on her return at the threshold of the sick-room.

No one but the patient eats or sleeps in the sick-room, and no food is ever allowed to remain in the sick-room except when the patient is actually being fed. Food once brought into the sick-room does not, however, ever leave it in edible condition. What is left over is promptly destroyed by being saturated with an antiseptic solution and then thrown into the fire. Fresh, clean food is always offered to the patient and nothing from a previous offering. Drinking water for the patient, however, is kept in the room in a covered vessel or bottle, and the patient is encouraged to drink freely of it. It should be cool but not ice cold. It helps in the dilution of the toxins and, therefore, probably assists the kidney tissues resist damage to their structures by giving them a weakened poison to handle as it comes to them in the circulating blood for elimination with the urine. For this same reason, it is also a source of protection for the other structures of the body.

The dishes, spoons, glasses, knives, forks, etc., used by the patient do not leave the sick-room, but are cleaned in boiling water, well wiped off with cloths dampened with an antiseptic solution, and then either wrapped carefully in clean cloths or put away in a covered receptacle of some kind, preferably glass, for then the contents can be exposed to the sunlight when not in use. Before being used again they are "scalded" in or with boiling water. The things used by the nurse, even though not in the sick-room, are kept separate from those used by the rest of the family, so that she can have them only, and are washed separately from the rest of the things.

A special thermometer, for the use of the physician and nurse, is kept in the sick-room immersed in a glass receptacle containing a

1:20 carbolic acid solution. It is carefully wiped off before being used and immediately returned to the solution when the reading is taken. In this same solution is kept a tongue depressor to be used in the throat examinations. Before this is used on the patient it is treated the same as the thermometer, and likewise is immediately returned to the solution after use. If the physician has to use anything else on or about the patient on the occasion of his visit, he carefully disinfects it before leaving the sick-room.

All of the foregoing is what you are going to tell your nurse as a part of your general directions in regard to your patient, but in looking after the welfare of your patient do not neglect the well-being of your nurse entirely. She also must be protected from the disease; and, while the trained nurse may have some of the necessary knowledge for self-protection, it is best to assume she has not, and talk to her just the same as if you were talking to a member of the family who was heroic enough to take upon herself the dangerous task of nursing the diphtheria-stricken patient, and naturally who would know nothing about how to protect herself against the infection. In the first place, it should be the rule to give an immunizing dose of one thousand units of antitoxin to the one who is going to be constantly in contact with the sick person. A trained nurse may object to this, but you should insist upon it where the nursing is going to be done by a member of the family or by other than a trained nurse. As a matter of fact, all the members of the household should receive an immunizing dose of the antitoxin and, also, anyone who has been in intimate contact with the patient just before the onset of the disease. The dosage will be a thousand units, unless in the case of an infant, when perhaps five hundred units may be used. This is a most efficient precautionary measure against the spread of the disease and for the protection of the persons who have been so exposed. You will insist upon your nurse gargling her throat with a fairly strong antiseptic solution about every four hours or thereabouts and attending to the nose also as a prophylactic measure. You will advise her to inform you promptly of any feeling of soreness in the throat or should she acquire a nasal discharge, and you should examine carefully her throat daily. Needless to say, almost that with the first sign of illness, she should promptly be relieved from duty and kept in strict quarantine until you are sure she has not acquired diphtheria.

If, for any reason, the immunizing dose of antitoxin has not already been given, it should now be given in an increased amount and the usual nasal and throat cultures should be promptly taken and sent for the usual bacteriologic examination.

And you, Mr. Physician, must be careful in your visits to your patients suffering from this disease that you do not carry away with you an infection for your next patient or to your loved ones at home. It has been claimed, only too often, and with perhaps some reason in some cases, that the indifference or carelessness of the physicians in attendance on diphtheria cases has been responsible for the spread of the disease. This is a charge we can ill afford to have brought against us who should, by force of example, show the public the value of care and caution in retarding the spread and ravages of communicable diseases.

In visiting the sick-room, the physician should remove his upper outer garments, turn up the bottom of the trousers and roll up the shirt-sleeves. He should then completely envelop himself in a washable gown of the same style as that worn by the nurse. He should also wear a cap of the kind as that already described as part of the sick-room costume of the nurse. Before leaving the sick-room he should at the threshold discard these things, thoroughly disinfect his hands and face and gargle his throat with an antiseptic solution. These precautions are highly important for the protection of others and himself.

In view of all that has already been said, it seems almost quite needless to say that the strictest quarantine possible should be maintained about the sick-room. In fact, the house itself should be placarded in a very noticeable manner so that people will see the "danger sign," and know enough to stay away from it; but, in case they do not remain away, it should be positively understood by your nurse that absolutely no one should enter the sick-room under any pretext whatsoever. She positively must obey this rule, and the only exceptions should be by your special order given either in person or in writing. This prohibition will include members of the household, and see to it that your nurse so understands. Naturally, any members of the family attending schools or colleges are kept at home and most carefully watched. If, at the end of seven days' complete isolation from the patient, they show no signs of illness and nose and throat cultures are negative after two or three bacteriologic tests, they may be per-

mitted to return to school, providing that while the illness continues at home they live temporarily somewhere else where no illness exists. A house is to be considered under quarantine until your patient is thoroughly well as judged by clinical signs, and bacteriologic examinations of, at least, two nose and throat cultures are shown to be negative, and the premises where the disease has existed has been given a most thorough fumigation. Then and not until then are visitors to be allowed.

The treatment of diphtheria is very simple in early cases. In all cases it must be considered under two headings—local and constitutional. The constitutional treatment, in a case of any severity at all, is the most important for the local or primary site of the disease, and its extension in this vicinity is dangerous usually only from its mechanical aspect and from the fact that it is the site of the factory, as it were, where the dangerous toxins of the Klebs-Loeffer bacilli are being manufactured and from which they are being circulated throughout the body through their absorption into the blood and lymph streams at these points. Therefore, while the local manifestations of the disease are being properly cared for, your main treatment will be directed towards overcoming its constitutional effects.

The first step in the constitutional treatment is the earliest possible administration of a proper-sized dose of antitoxin. This should be from 7500 to 15,000 units in ordinary cases which are seen early, and should be proportionately increased within reason the later the case is seen. Smaller doses, of course, can be used in mild cases of simple tonsillar or faucial diphtheria, but in laryngeal diphtheria give large dosage at once and be on the safe side. Recent investigations seem to show that it is the initial dose that counts the most, and that, therefore, this should be as nearly adequate to do the work assigned to it as can possibly be judged. There is no chance of doing harm, so far as we know, in the free use of antitoxin; therefore, rather an overdose than an insufficient quantity. And again, I say, administer this adequate dose of antitoxin just as early as you can, for bear in mind that antitoxin is only of service in combating the free toxins that are circulating in the blood. It can neutralize them. It is absolutely of no use, however, against the diphtheritic poisons once they have entered into combination with the body cells. This must be borne in mind constantly, for it is to prevent this very disastrous combination against

the health of the patient that antitoxin is used. Therefore, if you see a case that suggests diphtheria to your mind, administer the antitoxin at once without waiting for the report of a bacteriologic examination; if you see a case that in your judgment gives a clinical picture of diphtheria, administer antitoxin at once even though your bacteriologic report be negative. There are many reasons why a negative report under such conditions should be disregarded. The culture may have been improperly taken, there may have been something wrong with the culture media, the preparation may have been defective, the examiner may have been at fault, or the error may have been from one of several other causes. It is very desirable to have a reliable bacteriologic report to back up one's clinical judgment, but it is also very dangerous to depend upon it exclusively. Do not think that I am advising against the taking of throat cultures or belittling their importance as an aid to diagnosis. Far from it, as you can judge for yourselves, when I state that in my own practice I make it an invariable rule to take cultures from the throats of all small children with any subjective or objective throat symptoms at all or with suspicious bloody or irritating nasal discharges, particularly if these discharges have persisted over any length of time, and from all older ones where the slightest doubt exists in my mind as to the correct diagnosis. Rather an innumerable number of unnecessary cultures from the nose or throat than what might prove to be a fatal case through lack of proper diagnosis and the correct treatment instituted early enough.

Just how much good repeated doses of antitoxin will do is problematical, especially if administered in the usual subcutaneous manner, but until it can be absolutely stated without room for doubt that repetition is either dangerous or useless, the first dosage can be repeated or smaller or larger dosage given within twelve hours in case the progress towards recovery, so far as the action of the antitoxin is concerned, is not as satisfactory as it should be, and still further doses of antitoxin can be used later in an effort "to stem the tide" if your case is going against you. However, to get anything like really good results from later doses of antitoxin in a reasonable time, or even with initial doses in desperate cases, or in cases seen late in the disease, give your antitoxin intravenously. There is a very good reason for this advice. Experiments by various authorities on antitoxin medication seem to indicate that the subcutaneous injection of antitoxin is received into

the blood, the increase in the blood contents of the antitoxin reaching a maximum between the third and fifth day, after which there is a steady decrease in the amount present. By intravenous injection of the antitoxin the maximum amount of the serum is in the blood stream at once and thereafter steadily decreases. But again, it is to be stated, and very emphatically, give a sufficiently large dosage as an initial injection so as to avoid, if possible, the necessity for repetition.

To know whether the antitoxin which you have injected is doing the patient any good you look for the following, which should be observed surely within twenty-four hours, and many times within from twelve to fifteen hours.

The membrane which has been spreading quite rapidly is checked in its advance, shows a tendency to break down and come away from the parts to which it had been adherent, the temperature rise is checked and, in fact, the fever begins to abate, the restlessness and general symptoms of nervous irritability are lessened, and heart action and pulse seem better.

The next most important step in your general treatment is going to be the thorough cleaning out of the gastro-intestinal tract. This is very necessary, for you do not want your patient's strength to be decreased by gastro-intestinal disturbances nor the vitality lessened by the poisonous gases of fermentation and putrefaction. Therefore, constipation must be avoided and an initial cleaning out of the tract is indicated. The most reliable drug to be used for this purpose, it seems to me, is just old-fashioned castor oil. One of the various "tasteless" (?) preparations can be used or the plain oil given ice cold or in orange juice, hot or cold milk, pineapple juice, or any other agreeable liquid to disguise the taste, and when you use castor oil for this purpose give it in a sufficient dosage for the action you intend to have it accomplish. Half an ounce should be the minimum, and unless the patient is very young, an ounce is still better.

Later on, in case the bowels do not perform their function properly, any one of a number of mild laxatives can be used. Do not expect too much, however, in the way of a bowel movement after the initial cleaning out, for remember with the light diet, which I will speak of later, in vogue in this disease, the intestinal waste will not be excessive. I call this seemingly unimportant detail to your special attention so that the patient's strength will not be sapped by unnecessary catharsis

or the fluid content of the blood lessened thereby, permitting the anti-toxin to be present in a less diluted state.

Having a constitutional disease to deal with in which strong toxins are floating throughout the body, in the blood and lymph stream, it is not strange that certain important organs and tissues must be watched carefully for any signs of the deleterious effect these toxins might have upon them. The diphtheria toxin seems to have its greatest effect upon the heart and the kidneys and the tissues of the nervous system, therefore, these must be watched most carefully during the course of the disease. This means in the case of the heart that care must be taken to make the work of this all-important organ as light as is possible to avoid putting even the slightest unnecessary strain upon it. This is best accomplished by having your patient rest quietly in bed, no matter how slightly ill he may appear to be, avoiding all unnecessary movements, and having the heart action under particular watch from 1 A.M. to 4 P.M., when the general body vitality is at its lowest ebb. Be very particular and specific in your instructions to your nurse as to what you want done at this time under certain conditions, for any hesitation in emergencies arising at this time may cause a fatal result to your patient. We will speak of this again, when medication and stimulation are spoken of.

In almost every case of diphtheria an albuminuria will be noticed; but unless other symptoms of an acute nephritis be present, no special medication need be directed to the kidneys, but a most careful watch must be maintained so that you will not be taken unawares by a sudden breakdown of the urinary system.

I have already spoken to you about the sick-room, and I want to add to what I have already said that this room must be well-aired, cool, but not cold, and as a bronchopneumonia is only too often a complication—a complication to be dreaded—the bed coverings should be sufficient to keep your patient comfortably warm, and sudden exposures to lower temperatures should be avoided.

The length of time your patient must be kept in bed is going to vary. In the ordinary case, perhaps, three weeks will be sufficient; in more severe cases, six weeks or more may be the required time. In some very exceptionally light cases, ten days may suffice. A good deal depends upon the condition of the heart, which even during late convalescence will bear the closest watching, for oftentimes the slightest

strain will quickly bring about most unpleasant consequences several weeks after you have pronounced your patient well.

The diet in diphtheria is going to be principally liquid, with milk and predigested foods as our main reliances. As convalescence advances and local throat symptoms subside to a degree making the act of swallowing a less painful procedure, we will add strengthening semi-solid foods to our dietary, gradually getting back to a normal diet as our patient's condition warrants it. Feeding your patient is going to present some difficulty to you. The breast-fed baby, for instance, is going to continue to be fed breast milk, but is not going to get it in the usual manner by being put to the breast to suck. The milk is going to be withdrawn from the breasts of the mother by the usual artificial means and fed to the baby by a dropper or ordinary nursing bottle. When both of these two procedures are impractical because swallowing is difficult through pain, swelling, or other cause, gavage must be the means of getting in nourishment, for the nutrition of your patient must be maintained, since it is the resistance of the body on which you count to combat the toxins of the disease. It must always be borne in mind that antitoxin is not a specific cure for the disease, inasmuch as it has absolutely no effect in checking or restraining the destructive or toxic powers of the diphtheritic poisons already absorbed.

In bottle-fed children, the food is continued the same as before, except it is somewhat reduced in strength and made up in barley water if a tendency to diarrhoea be present: oatmeal water is used as the diluent if the patient is inclined towards constipation. The amount of reduction necessary in the strength of the food is going to be judged by the patient's digestion. Be very conservative and rather underfeed slightly than get up a possible gastro-intestinal disturbance, for again I remind you of the fact that it is your patient's vitality that is going to count in his battle for life after the antitoxin has checked the further flow of diphtheritic toxins into the body by its destruction of the Klebs-Löffler bacilli. If the milk is not well digested at any time, you may have to order it prepared in a partially digested state before it is ingested. However, do not use it this way any longer than is absolutely necessary, as it is not good for a stomach capable of doing its work to have its normal functions anticipated for it. Predigested foods are good in these older cases, not only for their ease of assimilation, variety in the limited diet, but also because of their alcoholic

content. In these older cases you will also come across some where fond, but foolish, parents who have permitted their offspring to have other things besides milk, and to whom the administration of milk will either be attended with great difficulty or be practically impossible. Here again, these prepared foods plus light nourishing broths of various kinds will be found valuable in the feeding of your patient. In these older cases, gavage must also be used when practicable if food cannot be ingested in the normal way. In these cases of difficult feeding, where gavage is not practicable, rectal feeding must be resorted to for the purpose of keeping up your patient's strength. The advisability of giving plenty of cool, fresh water to your patient has already been spoken of, but will bear repetition. Orangeade, lemonade, or Jugo de Piña (fresh pineapple juice) is also to be strongly recommended with a reservation against sweetness. If I cannot get the fresh pineapple juice I use the best pineapple juice in bottles that I know of, looking for one that has the least sugar added to it. It is given diluted in water to lessen the effect of the sugar syrup that has been added to it. I might state that in all throat troubles, especially those with exudation, I always order pineapple pulp to be eaten and the throat to be sprayed or gargled with pineapple juice. Pineapple is an excellent stomachic and, in common with many others, I feel quite certain that it has an influence on the exudation. I have been informed that in the Hawaiian Islands it was considered of great value in diphtheria before the introduction of antitoxin, and is still used as an aid to it. How true this is I do not know.

Where there is some gastro-intestinal disturbance, home-made full fat buttermilk may be tried, changing to fat-free home-made buttermilk if the former be not well tolerated. The administration of a reliable preparation of lactic acid tablets will also be found of service in this condition.

At the first sign of heart weakness, as indicated by feeble, irregular, or slowed pulse, a weakened and shortened first sound with reduplication in many instances, cold extremities, vomiting and great prostration, you will commence immediately active stimulation for its support. The importance of this cannot be overestimated when you are told that twenty per cent. of all deaths in the course of a diphtheria are from "heart failure." The time when the stimulation is usually most needed is, perhaps, some time during the first week, but it may

be needed from the very outset. This is especially true where the invading host is a mixed infection of great virulency or where the infection finds a weakened resistant power.

Alcohol in the form of a high-grade whiskey or brandy seems to be the stimulant considered the best by all authorities. Give small doses where these will be sufficient to support your patient, but give larger ones up to the amount necessary where the smaller doses are not enough. The average daily allowance spread out over the twenty-four hours is from one to three ounces well diluted in water, but where this is not sufficient for your purposes, no less an authority than Dr. A. Jacobi, to whose practical and clinical knowledge our entire profession will listen with respect, orders that it be pushed to the limit and cites many cases where fairly young children have taken as much as a pint a day with recovery as an end result in apparently hopeless cases. Of course, the amount in any case is reduced so soon as it is possible safely to diminish the liability of any damage to the kidneys or other organs. Other heart stimulants, used alone or in conjunction with the alcoholic stimulation, are strychnine, which can be used in large doses, as the diphtheritic toxins seem particularly antagonistic to it; camphor, caffeine, sodium benzoate, ammonium carbonate, strophanthus, and digitalis. Again, I recall to your mind the dangerous early morning hours, and suggest that your alcoholic stimulation be so planned as to have your patient well fortified against this time, and to further guard against unpleasant accidents by having a freshly-loaded hypodermic syringe ready for instant use in case of necessity. Forewarned is forearmed.

The physician in the examination of his patient will put as little strain on the sick one and do everything possible to avoid fatiguing him. Let his examination be thorough, but without "fuss or feathers," and quickly over with. The nurse, also, must look after the patient's comfort and welfare in the most careful and painstaking manner, yet likewise must avoid tiring the patient mentally or physically and perform the necessary duties in as unobtrusive a manner as possible. Every movement of the patient is to be done with as little effort on his part as is possible, and these movements are to be reduced to a minimum. Your nurse must take as much of the action of these movements upon herself as she can. I always tell them they should even think for the patient if it were possible. This is all in keeping with the

sensible policy in this disease, at least, of conserving every bit of your patient's strength possible owing to the uncertainty as to just how much the heart has been affected by the toxins. The fact that twenty per cent. of all deaths in diphtheria are due to heart complications must constantly be borne in mind and acted upon in your treatment of your cases. Fatigue, strain, and gastro-intestinal disturbances, besides an overwhelming toxæmia, are the greatest menaces to the heart.

Before taking up the local treatment and saying something about the stage of convalescence, it may be well to speak a little about antitoxin in general and the places where it may best be injected. It seems almost needless to say that, in choosing the particular brand of antitoxin which you are going to inject, the reliability of the preparation and not any price consideration must influence you in your choice. Also, let the amount of your dosage depend upon the needs of your patient and not be smaller than your judgment suggests because you are using an expensive serum. This may seem a foolish and unnecessary piece of advice, but that was the excuse of a physician in a certain case where a very inadequate dosage had been used. You want an antitoxin of high concentration for obvious reasons. The fresher the serum the better, and it seems advisable that none over three months old should be used and especially in severe cases where the strength of your antitoxin is going to count for much. Some say that antitoxin can be safely used even up to an age of six months, but personally I believe the fresher your serum the surer you can feel that your results are going to be better. Most agree that after nine or ten months the efficiency of any antitoxin is going to be less. The safest kind to use according to my idea is that which comes in sealed syringes with sterile needle carefully wrapped, all prepared for use in the particular size dose that you wish to inject into your patient. Poorly made, impure, contaminated, or "spoiled" serum is likewise useless and dangerous to a varying degree. The dry form of antitoxin is not considered as desirable as the usual serum of high concentration, and is only to be recommended for use when the usual kind is not obtainable. The more concentrated your serum is the less apt you are to have your patient get up a constitutional reaction to the injection, which is shown by pain at the site of injection, a general eruption over the body, usually first observed, or rather starting, at the point of injection, and

at times quite a little fever. This may be followed by general malaise and painful, swollen joints. These symptoms usually manifest themselves about one week after the injection and gradually disappear without treatment, but are very disagreeable and annoying while they last, especially the itching of the skin and the painful joints. Something may have to be done to relieve these two conditions. Many experiments have shown that antitoxin is of absolutely no use when given by the mouth or *per rectum*. The injection of antitoxin is given into the subcutaneous tissue. Some give it into the abdominal wall, some give it just beneath the scapula of either side, and still others in the buttocks. I was taught to give it into the upper and outer side of the thigh and have seen no reason to change from this place because some other spot seemed more advantageous. The main thing is to give it early in those cases that need it and give it under surgically clean conditions. Pinch up the skin, which has been painted with a little tincture of iodine, insert your needle fairly deep, and give the contents of the syringe not too quickly. When the syringe is about empty commence to withdraw it so that by the time it is empty it is entirely withdrawn. If there is a tendency for some of the antitoxin to flow out at the site of injection hold the skin together at this point for a few minutes and, if necessary, seal it with a dressing. Personally, I usually paint it again with a little iodine when I have finished. If you are using antitoxin in anything but the sealed container, or are not using all that the container holds, the balance should be used up in the next week or thrown away for fear it has become in some way contaminated. While you are keeping it, the bottle, or whatever it is in, should be most tightly sealed and put away from the light in a cool or, perhaps I should say, cold place. When you take it out to use it again be sure not only that your hands must be clean, but that the needle and syringe that you draw the serum up into must be absolutely sterile. A general infection or even a local abscess will not add to the comfort or well-being of your patient.

The local treatment of diphtheria is not so vigorous or so strenuous as it was before the introduction of antitoxin. The reason for this you can readily understand when you recall what has already been said about the action of antitoxin, particularly its wonderful solvent effect upon the membrane. What is to be done depends upon the location of the local manifestations of the disease and the severity of

them. The local manifestations are usually only a menace to the patient in a mechanical sense. Of course, they may be painful and cause great discomfort, but in most cases where the antitoxin is doing what it should this is short lived.

In nasal diphtheria, where much discharge is present or where there is a feeling of being "stuffy," a warm normal saline solution can be used with advantage as a cleansing douche several times a day, depending upon the necessity for it and your patient's condition. Unless there is a great necessity for it, it is done a minimum number of times where the patient fights against it. As the nasal discharge is usually very irritating and excoriating, a bland ointment should be used about the external opening of the nostrils and on the upper lip for protective purposes. Do not try to force membrane away from the mucous membrane. It is harmful and you can only succeed at the expense of causing bleeding, excoriation, and ulceration, besides opening up better avenues for the absorption of the diphtheritic toxins; therefore, you can readily see that you will have done no good.

The mouth and pharynx must also be kept clean, and this can be done by spraying, gargling, or syringing with either normal salt solution, pineapple juice, weak solution of Dobell's, or any other of a great number of mild antiseptics. The number of times these measures should be carried out are governed by the same things spoken of in connection with nasal diphtheria.

In laryngeal diphtheria, medicated steam inhalations consisting of vaporized calomel must be used at intervals, which may be from one to three hours, and between these medicated inhalations simple steaming is indicated. If in spite of these inhalations and your previous injections of large doses of antitoxin the danger signs of increasing laryngeal stenosis keep steadily increasing, you must resort to either the use of the O'Dwyer tubes (endolaryngeal intubation) or tracheotomy.

There are advantages and disadvantages to both procedures, but there can be no doubt that where it is practicable intubation should be the procedure of choice in every case, and while it is far from a simple thing to accomplish, it is much easier on your patient and his parents. It is a bloodless operation. While in large cities, perhaps, it is not absolutely necessary for a physician either to own a set of O'Dwyer's tubes or to be skilled in the technic of using them because of the ease of secur-

ing competent assistance, or having special hospitals for this disease at his service in case of emergencies, in smaller cities, towns and villages, etc., every physician should own a set and have endeavored to become proficient in its use. Tracheotomy is a surgical operation requiring surgical skill for its proper performance and good after-results, and all are not even indifferently good surgeons. Where intubation fails, however, tracheotomy will have to be performed as a last resort. In conjunctival diphtheria your local treatment will be keeping the eyes thoroughly clean by frequent washings of normal salt solution or very mild antiseptic solution. Two or three times a day a few drops of a reliable silver preparation can be instilled into each eye.

In cutaneous diphtheria the local treatment will be to keep the wound or excoriation, which is the site of infection, absolutely clean by keeping it covered with dressing of fifty to sixty per cent. alcohol.

The reason for using a diluted alcohol is due to the fact that it is a better antiseptic than absolute alcohol.

Aural diphtheria is really only an extension of the primary disease from the pharynx. It is extremely painful, being accompanied at times by terrific headaches. It sometimes has as an end result tympanic necrosis. The pain must be controlled. A few drops of a five per cent. phenol solution in glycerin may be dropped into the ears three or four times a day. If the usual indications are present the ear drums must be incised and weak hydrogen peroxide solution used to wash out the middle ear.

Having been fortunate enough to have guided your patient through the acute attack of the disease, you will arrive at the stage of convalescence and here, also, your patient must be watched carefully if no setbacks are to be his portion.

His heart will still merit your closest attention, and any irregularity or other abnormality means a prolonged convalescence because you will keep him in bed for complete rest, gradually permitting a sitting posture as his condition allows it. And, may I say here, that antipyretic drugs with their heart-depressing action have absolutely no place in this disease either during the active or convalescent stage. This is an important fact to remember. Your medication, besides being directed at the heart, will have for its object the overcoming

of the very great anæmia existing and the building up of the wasted tissues.

The tonic medication will have to be continued for several months after your patient is on his feet again. You will warn him to be careful for some time against overfatigue, sudden strain, or excitement. He is to be instructed to lead a quiet, out-of-doors life, with regular hours of eating, resting, and sleeping. Do not let the slow pulse of this disease fool you. We are so used to speaking of the weak, rapid pulse in pathologic conditions that the dangers of an abnormally slow pulse are liable to be forgotten. It is the worst sort of a pulse to have in this disease and means absolute quiet and rest for the patient unless you wish a fatal result. Holt states that morphine is invaluable when given in full doses, from every two to four hours in cases of threatened heart paralysis occurring late in the disease or during convalescence.

Another feature of the convalescence which will engage your attention in many cases is the post-diphtheritic paralysis. It is usually anywhere from seven days to four weeks after the membrane has cleared up.

It is a paralysis of the flaccid type, but fortunately is not permanent.

The parts first affected are usually the soft palate and the pharynx, and then the eyes, the legs, the back, or the neck muscles may be involved. The best treatment is massage and electricity, to keep up the tone of the affected parts. Paralysis of the respiratory muscles is always dangerous to life and, if the diaphragm becomes affected, death ensues. If nutrition is interfered with, owing to the muscle involvement, tube feeding must be resorted to until the danger of starvation is over.

In all cases of diphtheria of even moderate severity it is several months before your patient is himself again, so here is proven the old saw, "An ounce of prevention is worth a pound of cure." With proper isolation and quarantine this dangerous disease will gradually become less and less. Be sure in your cases an efficient quarantine is maintained and that your patient will not be a disease carrier, by making sure they are free from diphtheria bacilli before permitting them to mingle with others. Our present rule calls for two negative cultures from the nose and throat before the patient is released from quarantine.

THERAPEUTICS OF THE FOOT

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To show what a variety of conditions and what interesting affections may be met with in one region of the body, we have chosen, as a departure from the ordinary method of considering a system, to take up a study of the foot, or rather both feet of an individual, both in health and disease, and ascertain what can be done for these neglected members.

Man, by virtue of his upright position and walking erect, has naturally fallen heir to many affections of the feet, more than are found in the hands. These conditions should be early recognized as departures from the normal in order to avoid serious trouble.

The human foot should have for its fundamental support moderately porous bones, held by strong ligaments, and movable within limits over synovial membrane, strengthened by freely movable tendons and muscles, and padded by a quantity of fibrous tissue, coarse fat, and skin to act as cushions; it should also be furnished with a free supply of arteries, veins, lymphatics, nerves, and accessories to the skin.

There are two longitudinal arches with free movement allowed about the astragalus (78° of flexion and 42° of abduction on pronation at Charcot's joint-line). The inner portion of the arch is made up largely of the astragalus and scaphoid, and the outer, astragalus and calcaneum. At the sides, the capsule is close to the skin. The transverse arch is formed by the scaphoid, cuboid and cuneiforms. The heads of the metatarsals may spread so much as one-half inch; the fourth has the most freedom.

No two individuals have exactly the same kind of feet; and, moreover, no two feet of any one individual are exactly counterparts any more than any two eyes are exactly alike. Two horses may resemble one another very closely in age, size, form, color, strength, and disposition, but at the same time there is likely to be considerable difference in their exact lines and endurance or speed; they are not perfect

matches in nature. Symmetrical development of both sides of the body is rare; very few persons are ambidextrous, most are right-handed and some are left-handed Benjamites, according to the development of centres about the island of Reil on one or the other side of the brain. There is not such wide difference in the development of the lower extremities, because in using them we generally have to use them about alike. Some armless individuals, however, have acquired considerable skill in writing with one foot or the other.

It is immaterial whether we discuss conditions of the foot starting from the ground-structure within or go from the outside surface in, but let us take a case as we see it, and inspect the skin first, and then proceed deeper as though dissecting the structure. Not infrequently there are met people who complain considerably about undue and perhaps malodorous (bromidrosis) perspiration of the feet, beyond what is physiological. In some sympathetic lesions, in which there is unilateral sweating and change of local temperature, there may be sweating of only one foot. With excessive sweating, or hyperidrosis, as it is called, there is frequently a thickening of the epiderm of the soles; especially is this true in a form that shows the condition in a number of members of the same family. The soles and palms are quite thick and painful in these cases as a rule, amounting practically to a keratosis. Lesser has observed that most cases of local hyperidrosis of the feet are in flat-footed individuals. Probably the most efficacious remedy is formalin solution, one dram to the pint of water. The French are fond of using balsam of Peru. One per cent. solution of quinine in alcohol is also recommended, together with the use of mineral acids internally. Tannic acid or alum lotions (one ounce to the pint) are also used, and finally X-ray exposures have proven beneficial. In cases of bromidrosis, boric acid, in addition, is used. Dermatitis venenata, or ivy-poisoning, from walking among the *Rhus toxicodendron* (poison ivy), and other irritating vines (primrose, etc.), is often found on the feet and legs. The minute vesicles soon formed by it, as a rule, are readily dried up, and the itching relieved by a mild lotion such as: Phenol, 0.5 Gm.; bis. subcarb., 2 Gm.; aq. ad. 30 Cc.

Various forms of eczemas are found on the feet, particularly a vesicular or a verrucose eczema on the dorsum and a squamous eczema on the sole with fissures. The vesicular form is treated best by means of an ammoniated paste (hydrarg. ammoniat., 1.5 Gm. to Lassar's

paste, 30 Gm.), or a calomel paste (0.6 Gm. to 30 Gm.); the squamous variety is treated with ung. pic. liq., 1 part to 8 of petrolatum. A persistent eczema between the toes is sometimes best handled with silver nitrate.

A corn (clavus) is only too well-known a lesion to need any description. Sometimes there are a number present on both feet where pressure is expected to be met between the toe and shoe. The logical treatment is to prevent pressure by using properly fitting shoes. A convenient application consists in: ex. cannab. ind., 0.6 Gm.; ac. salicyl., 1 Gm.; alc., 1 Cc.; æther, 4.5 Cc.; collod., 15 Cc. This should be painted on three times daily for a week, the foot then soaked in warm water and the hard corn removed. It is confusing and useless to have too many vague remedies for these affections when one good one will answer.

A bunion is quite a different proposition. It is really a subluxation of the first metatarsophalangeal articulation, producing a hallux valgus, and generally accompanied by redness and soreness of the projecting parts. It, too, is to be prevented by using properly shaped shoes. Its correction consists in cutting off with bone-shears, under aseptic precautions, the inner half of the head of the first metatarsal and base of corresponding proximal phalanx, straightening or over-correcting, suturing and applying a "pistol-splint." This condition is mentioned here because with it there is generally a callosity in addition over the most prominent part, and sometimes an ulceration of the skin.

Pompholyx is a rare skin affection of the feet in which there are rather large, tense, oval vesicles, sometimes amounting to blebs and containing pus, and in which there is found a burning sensation. The disease is generally found in those beyond middle age and in poor health. There may be in addition considerable sweating present. A dusting powder, as of pulv. zinc. oxide and amylum, should be used locally and the patient given arsenious acid.

It is well to have in the mind's eye a picture of what conditions are more common in a given locality of the body; and, therefore, what we may expect to find in examining that part. Scabies lesions are not so likely to be found on the feet as on the hands, except in some small children. Warts are more common on the hand, though they may be found on both extremities, etc.

Affections of the nails are to be looked for in both hands and feet. When examining the toe-nails, there is apt to be found a hypertrophic condition accompanied by great thickness of the edge, particularly in some old people (onychogryphosis). This continues, especially if there is uncleanness, pressure and neglect, and it sometimes necessitates surgical interference.

"Infleshed toe-nail" is a not infrequent occurrence in those with neglected nails and wearing pointed shoes. It is really a condition of ulceration, with excessive and painful granulations about an irritating down-curved corner of nail. Broader shoes must be ordered for these cases, the granulations reduced by applications of silver nitrate stick, and sometimes the nail split lengthwise under novocaine and extracted with forceps.

Atrophia unguis is a state of partial death of a nail. In these cases there may be seen white and brittle areas in the nails, and the person's vitality is likely to be lowered. Sometimes there is quite an extensive diseased condition with wasting of the nails in eczemas, pus infection, ring-worm of these parts, and particularly when the disease favus attacks the nails of those having this disease. At times Achiorion Schoenleinii may be demonstrated in scrapings from the nails of these cases (more likely the finger-nails). The proper treatment then is X-ray exposures.

Now, in addition to looking at lesions on the feet and determining what pathologic process is going on locally, we must remember that general eruptions, as from the excessive use of bromides, burns, scalds, erysipelas, infections, etc., may be found naturally on the feet as elsewhere. Specific lesions are rather common on the feet, especially papules and scaliness of the soles. Such lesions found on the feet of babies will often make a diagnosis of the disease and early lead us to inunction or other radical form of treatment. These syphilides should not be confounded with squamous eczemas, and if there is doubt in the case a Wassermann test should be made. We should examine the soles and palms, in cases suspected of having been exposed to scarlet fever, to see if there is any evidence of fine scaliness.

The feet, because of their particular location, are often to be blamed for the entrance of the virus of several very disturbing maladies. One of these is tetanus. How often the simple stepping on

a rusty nail, whether with the shoe off or on, is responsible for the so dreaded disease tetanus gaining entrance through a seemingly insignificant punctured wound. This is one of the classes of cases where the opening must be surgically enlarged and the person kept off his feet, having the injured foot elevated. Free and early cauterization and administration of the antitoxin are to be recommended. Another disease, supposed to be picked up by the bare feet, is true elephantiasis; *Filaria sanguinis hominis Bancroftii* seems to prefer entrance to the body either through the lower extremities or scrotum. Amputation has been practised in some of these cases with success.

Symmetrical gangrene, or Raynaud's disease, may be found in the toes; it is a vasomotor affection. Nitroglycerin, or, better, the nitrites, should be given to these cases. Erythromelalgia is a less severe condition of the feet with redness and neuralgia-like pain; its nature is not clearly understood. Frost-bite, gangrene (arterio-sclerotic and diabetic), and perforating ulcer of the foot found in tabes are characteristic circulatory and nervous disturbances of the parts we depend so much upon for keeping going in our everyday life. Frost-bite will generally respond to cooling and gradually warming measures in a moderately cool room. The other conditions are stubborn and sometimes even amputation may be of no avail.

The superficial and deeper reflexes of the foot have proven of interest and considerable value in the diagnosis of nervous diseases. We are familiar, *e.g.*, with the ordinary plantar flexion of the toes through the lumbar cord as a result of the skin reflex when gently stroking the sole, and the gradual extension of the great toe, known as "the Babinski reflex," found in lateral column lesions. Peripheral terminals of the crurals take up impulses, and motor messages are sent to the parts in and about the foot and ankle; it is not easy to draw a sharp line of division between toes, foot, ankle, and leg. The lost achilles jerk is found in tabes dorsalis and neuritis; its increase and even ankle clonus are met in spastic paraplegia and multiple sclerosis. Neuritis (evidenced in alcoholic cases by "foot-drop," or loss of anterior tibial and peroneal control) is treated by rest of the foot with a pillow supporting the sole, internal administration of salicylate, bromide, and iodide, and locally 20 per cent. mesotan; later, galvanism and faradism may be employed, as also massage.

The movements of the feet take part in certain characteristic gaits

and postures of nervous states, as the ataxic gait of tabes, spasticity of spastic paraplegia, steppage and "foot-drop" of alcoholic multiple neuritis. Unfortunately, apart from the neuritis cases, not much can be done for the chronic nervous disorders affecting locomotion. Sometimes nerve-transplantations and tendon-transplantations help out.

Going into the deeper portions of the foot, severe contusions, sprains, and lacerations are common, and are treated as elsewhere, except they generally necessitate at least the use of a cane or crutch and, often, keeping off the foot entirely for a time. A neat and familiar method of strapping the foot and ankle consists in the alternate application around the dry foot and then around back of the heel of strips of adhesive not too long. This satisfactory support is of especial value when there is not too much swelling present. To reduce swelling, elevation and binding on of lint saturated with cold lead water and alcohol is beneficial. For fractures in this region (as Pott's fracture), the use of the Pennsylvania fracture-box is quite satisfactory, the important points to be observed being the pad placed under the tendo achillis to prevent decubitus under the heel, a pad above the seat of fracture, and towel at the sole of the foot, together with elevation of the foot of the bed. In fracture of a metatarsal or phalanx the ordinary plantar splint or a light plaster-of-Paris, or similar case, may be applied for a few weeks. Statistics at St. Thomas's Hospital showed that only three out of 1207 diseases had to do with the metatarsals.

Acute articular rheumatism and gout are to be met in the small joints of the foot. Do not mistake a large red swelling about the first metatarsophalangeal joint for an abscess, and attempt to open, as has been done, what is in reality gout. Salicylates, alkalies, lithia, and warm wintergreen locally will clear up the condition.

Luxations of the small bones of the foot appear to be rare. When such occur they are generally in association with fracture, just as luxation of a vertebra is also generally associated with a fracture in that region. One thousand and sixteen X-ray plates were gone over, and only one showed lateral luxation of the head of one metatarsal, and this case was reported. One plate showed outward displacement of second, third, fourth, and fifth metatarsals; one, fracture of first metatarsal; two, disease of metatarsals; two, pes cavus; two, absence of first phalanges and presence of bunions; one, part of os calcis re-

moved; one, displacement and fracture of all but first metatarsal; one, necrosis of cuboid; one, necrosis of os calcis; one, necrosis of tarsals and metatarsals; one, enlargement back of head of the first metatarsal; one, fracture and displacement of scaphoid; one, slight displacement of second metatarsal; one, presence of shot; one, necrosis of proximal end of third and fourth metatarsals; one, necrosis of middle of second metatarsal. Dislocations of these bones are generally difficult of reduction without open operations, and this is not always deemed best. The cases of necrosis need opening, curetting, and draining, and extensive cases demand amputation and careful attention to upbuilding the system.

Dr. T. G. Morton described, in 1876, a form of pressure neuritis caused by the squeezing of the adjacent fourth metatarsal upon the terminal sensory filaments of the plantar nerves. Nerve-stretching or sectioning may be practised in the worst cases. Manipulations of the foot, together with toe-exercises, properly fitting shoes to correspond to the Myer's line (which runs from middle of os calcis to middle of head of first metatarsal), together with appropriate steel braces in the shoe when necessary, all tend to bring relief to people suffering with "sore feet," as many of these cases are due to "flat feet" or other deformity of the arch. According to Hüter, the arch of the foot does not develop till after birth. Ordinarily, the well-developed inferior calcaneo-navicular ligament and properly developed arch prevent the "flat-foot." Trained nurses upon entering their duties at the hospital are liable often to suffer from the extra strain put upon their untrained ligaments and tendons, especially if they are themselves very heavy. They are frequent sufferers from "flat-foot." A good way to make sure the condition of the arch is to have the person, the sole of whose foot has been smeared with shoe-black or ink well up the sides, step on a plain sheet of paper, or the plain foot placed with full weight upon a charcoal-paper. If there is a very narrow connecting band in the middle, say about one-half inch wide, connecting the front part of the foot with the back, the arch is good. If there is no connecting band present, the condition is one of "pes cavus," while if there is a broad band we have a case of "pes planus," or "flat-foot." The negro race seems prone to have the condition of flat-foot, just as "bow-legs," "knock-knees," etc., are common among them from faulty nutrition. There may be a peculiar form of "flat-foot" from turning

the toes and soles too much out. There is an operation of chipping the articular surfaces of the astragalo-scaphoid joint, forming a dysarthrodesis, and drawing the extensor hallucis through the scaphoid and suturing, and then putting up the bent foot in a plaster case till healed, so as to correct a flat-foot.

The lower animals that walk on "all fours," it might seem, would have twice as many foot ailments as man, but, as a matter of fact, they have very few, except in the class of animals that are shod and shod poorly. They accustom themselves to hardships and changes and in this way resist. Man is responsible for a great many of his own afflictions. It is calculated, *e.g.*, that a young lady will cover as many as fifteen miles during one of her long fashionable dances, wearing, moreover, tight slippers, while not near this distance may be covered in making hospital rounds, against which perhaps she will bitterly complain. Man will frequently not even respect what members he may have left after having been deprived by misfortune, perhaps, of others; notwithstanding the extra strain thrown upon the one leg of a cripple, it is not an infrequent sight to see him reeling in an intoxicated state, or in other ways abusing the limb left. It is remarkable, it may be stated in this connection, what use can be gotten out of a well-fitting and properly cared-for artificial foot or leg.

Among the less common deeper affections of the foot may be mentioned epiphysitis of the os calcis, tumors of the foot, Charcot's foot, bursitis over the os calcis (Albert's disease), talipes equinus of congenital paraplegiacs (Little's disease), supernumerary digits and deficiency of digits (congenital and otherwise), luxation of peroneal tendons, dislocation or fracture of astragalus and calcaneum, Madura foot (common to India), ainhum—a spontaneous amputation of digit found particularly in Africa, congenital shortening of tendo achillis, and so forth. In some cases of Pott's fracture union may be facilitated by intentional lengthening of the tendo achillis by means of tenotomy. When any of the luxations of the foot occur they are mostly from forcible inversion.

Cretins show a slow development of feet and hands, and a peculiar short and stumpy condition of the phalanges. Of course, the other distinguishing features of cretinism are present. At nine years of age, *e.g.*, children with different bone diseases show difference in development of the tarsal and carpal bones. For convenience of skiagraphy

of the parts, the wrist was taken in a series of cases for comparison. At the ninth year all the carpal bones should have received their nuclei of ossification; these can be shown in a skiagram except in the case of the small pisiform, which by some is considered more of a sesamoid becoming ossified in the twelfth year. Upon looking at the skiagram of a hand of a rickety child of nine, the seven bones were clearly seen, but were widely separated and apparently not so well developed as they should be. In the case of a cretin at nine, the wrist was much smaller (about the size of that of a rickety child at three and one-half), and it had only two of the cartilages ossified (probably the os magnum and unciform), and the beginning of two more. In cases of retarded development the order of ossification apparently changes somewhat, as is the case with the eruption of teeth; though, of course, these are not bony. The os magnum and unciform, then, are first to appear and the semilunar or the scaphoid next. It was also noticed that greater development is obtained in children of the same age with taller frame than in those of less stature; *e.g.*, the trapezium and trapezoid were fairly distinct in the former and not so in the latter. These small bones are not so clearly worked out in X-ray studies of the ankle and foot.

When there is acquired swelling of the feet, as in œdema or localized anasarca, great comfort may be experienced by keeping the feet elevated as much as possible, and having applied from the toes up a circular, elastic, rather heavy and firm bandage to above the knees. General diseases, in addition, should of course be treated.

The various amputations of the foot through joints at points of election—the Pirogoff, Syme, Lisfranc, and Chopart—are technical directions indicating just what parts are to be removed and what parts left in accordance with the rule of leaving the best stump. In the case of the foot, we wish to leave as good and solid a stump as possible to fit an artificial appliance, rather than conserve digits. In tuberculosis of the foot bones (and the calcaneum is often thus diseased), curetting, draining, and injections of iodoform emulsion are practised, and sometimes amputation resorted to. Sometimes, in injuries and disease, the astragalus is wholly removed. Severed arteries and nerves are treated as elsewhere. Manipulations, massage, baking, use of electricity, etc., for club-foot (whether congenital or not), claw-toe (from paralysis of the tibialis anticus and Friedrich's ataxia), flat-foot and deformities resulting from abuse of these mem-

bers, may accomplish wonders with patience, without resorting to some formidable operation of choice and possibly leaving the patient a physical wreck.

Foot-and-mouth disease, rarely met in the human race, is a serious condition, and strict sanitary measures have been enacted to prevent it. It is rather strange that the Chinese, who are accredited with having been so precocious in many hygienic and remedial measures, should permit superstition to prevail over good judgment, rule mismanagement of the very foundations of their bodies, and permit deliberate foot deformity! Another curious paradox of modern civilization is the fact that shoe-shops the world over are made to subserve man's (and woman's) perverted vanity by catering to such ridiculous tastes in the way of styles of footwear!

It is high time we arouse special inquiry among our profession into the abuse and misuse of the foot, and not permit quackery to handle this part of the body and bring dire results, any more than handling the heart, nervous system, obstetrical or internal injury cases.

THE TREATMENT OF PULMONARY TUBERCULOSIS

BY PROFESSOR VEDEL

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Most physicians in France are agreed that the cure of pulmonary tuberculosis is effective if properly diagnosed as to its extent and stage, but there is much uncertainty in its treatment. The reason for this is that there is so much difference of opinion as to the therapeutics, even though the period of the disease has been properly determined. Again, many patients cannot afford either the time or the money for cure in sanatoriums, or at air stations. I shall, therefore, outline an effective plan of treatment that is available to everybody, together with hygienic directions.

Taking, for example, a case of chronic tuberculosis in which there is slight fever but no hæmoptysis, and still a fair digestion. Strict obedience to the physician's orders must first be insisted upon, and they must ignore the advice of well-meaning friends as to overeating. Their consent to take a rest must be obtained, and they must avoid exposure to sudden changes of air, or to night air, and getting into a perspiration. First, they must live as much as possible in open air of equable temperature. In winter, in mild climate and dry air, as the Riviera in France and similar climates in other countries offer. In the summer, it is best to take advantage of altitude, and go to the mountains. Rest of the mind by abstaining from intellectual pursuits, as well as club life, gambling, and excesses of all kinds, such as tobacco and alcohol, is of no less importance. Instructions as to proper disposal of the sputum in sanitary cups should be given. If the digestion is good, they must partake freely of meats, eggs, and fatty foods. Start them on one-half pound of pure uncooked mutton or beef a day. To prepare this, place a pound or two of raw hashed meat in one-fifth of its weight of cold water, and macerate for about two hours, then wrap in a clean linen cloth, compress, divide into small portions, and take at breakfast.

Our treatment has three objects: First, to tone up the patient; second, to prevent the formation and degeneration of tubercles, and try to eliminate them from the system, or at least to promote their

encapsulation or calcification, and to combat secondary infection; third, to fortify the digestive functions, which are usually below par, and to improve assimilation.

In late years, many drugs, such as quinine, kola, and strychnine, have been employed, and while these are not curative agents, still they have their indication in toning up the system. The remedies that have proven most efficacious in my hands are guaiacol, iodide of potassium, and iodoform with camphor. These act both locally and upon the whole economy and also have an antiseptic value. The objection is raised that they may provoke congestive symptoms, but this is avoidable, by not giving the large doses that had formerly been advised, or by not allowing too frequent repetition of dosage. To obtain a sedative action, potassium bromide may be added. Of course, it is understood that the sooner this treatment is begun the better the chance of cure.

There are two classes of patients: Those who have recently shown symptoms of phthisis after a pleurisy, and those who are already in the chronic state. For these I recommend the following formula:

R—

	Gm. or C.cm.
Potass. Iodid. ....	.6
Potass. Bromid. ....	.8
Strychnin. Sulphat. ....	.003
Tinct. Cinchonæ	ââ5.
Tinct. Coca and Kola.	
Glycerin.	
Syr. Aurantii Amer. ââ qs. ad	16.

M.—Sig.—Take at breakfast and lunch. To be continued for three weeks in each month, and then omit for one week.

I modify this sometimes by using syr. krameriaë, which is rich in tannin, or add Fowler's solution in certain cases. If the activity of the gastro-intestinal canal is sluggish, phenyl salicylate, three grammes a day, may be given in the afternoon and evening with a hot drink.

If the appetite is poor, nothing stimulates it so much as a mixture of Fowler's solution and tincture of nux vomica, as a bitter tonic.

After an attack of pleurisy, when infiltration of the apex is suspected, order a hypodermic of sodium cacodylate, .05 gramme, given in the arm, and repeat ten or twelve times. To this .001 gramme of sulphate of strychnia may be added.

If after pneumonia it is found that the febrile action continues, and tuberculosis is feared, use at once hypodermic injections of guaiacol .05 gramme in iodoform .01, and camphorated oil 10 to 20 grammes. This is to be continued until the fever has fallen in the evening hour. If the patient is very weak, add a milligramme or two of strychnine sulphate to the injection.

That variety of tuberculosis found in coal miners, stone masons, and other workers exposed to dust, readily yields to the above treatment.

In all the chronic forms of phthisis, I use this injection over a prolonged period, giving it at first only once in five days, and then only once a week. I repeat the first formula as we start it.

R—

	Gm. or C.cm.
Guaiacol .....	.05
Iodoform .....	.01
Ol. Camphorat.	10 to 20

The camphorated oil is made with pure washed oil and alcohol, both of which are sterilized.

The injection is given in the back of the arm or between the shoulders. If the solution is too thick, add a few drops of ether. Tell the patient that the injection will pain at the moment and for some few minutes afterwards. If he is weak, add a few drops of a solution of strychnine. In some cases I have tried eucalyptol in place of guaiacol, but have not found it to modify the symptoms so reliably as the latter.

I give the first mentioned prescription for some months, and when the patient has a quick pulse, I add digitalis or strophanthus.

For the cases with widespread catarrh, I use the following:

R—

	Gm. or C.cm.
Benzonaphthol .....	.5
Sodii Benzoat. ....	.3
Terpin. Hydrat. ....	.05 to .10
Lactose .....	.20

M.—Sig.—One wafer. To dry up the catarrh, give as needed, several a day.

A regular and persistent use of all the above methods gives us 70 per cent. of cures.

When the cough is very bad, I often add codeine, heroin, or

dionine in very small doses to the wafer to dry the catarrh, but do not like to continue it for a long time.

If hæmoptysis arise, all medication is stopped and the patient is forbidden to talk, and told to write what he wants to say, and be in complete repose. The only alimentation is iced milk in small doses every hour or two. Mustard synapisms are applied to the legs, and shifted about, and the legs are wrapped up with cotton wool and over this rubber cloth. I then inject one centigramme of ergotine, and give small doses of calomel until the patient is purged. In some I have success with chloride of calcium in large doses combined with opium. If necessary to get complete repose, we give a hypodermic injection of morphine.

THE TREATMENT OF DIABETES

BY PROFESSOR ALBERT ROBIN

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THERE are about seventeen different theories of the pathology and as many different forms of the treatment of diabetes, but these may be reduced to two. As to the pathology, Pavy thought that diabetes originated in the nervous system as a motor paralysis, the result of a pathologic glycogenic ferment. Hence arose the use of antiseptics, such as creosote, carbolic acid, and iodoform, in the treatment of diabetes.

While the phenols and iodoform diminish the sugar, they seem to destroy the blood cells, necessitating great caution in this form of treatment, and even its abandonment. Then came the yeast ferments, extract of thyroid gland, serotherapy, and diastase, but the results are inconstant. Brewer's yeast has reduced the amount of sugar from eighty to fifty grammes in some of our patients, but we consider it as an adjuvant only to a cure.

In diabetes all the chemical processes of metabolism, including the glycogenic, are increased. This is of such great importance that an attempt to regulate the liver function to the extent, at least, of suppressing ingestion of sugars, should be made.

General hygienic directions as to the avoidance of fatigue, of excitement, and the advantages of oral cleanliness and frequent baths to favor elimination by the skin, should be given.

As to the proper diet, there are four great schools in France. Professor Bourchardet once said that he who loses much must eat heartily to repair the constant waste, but nowadays we know that it does not do to stuff patients until they become toxic. The other schools advocate the milk diet, the meat diet, the oatmeal and cereal foods of van Noorden, respectively. Pure milk seems to increase the sugar at first, and meat diet gives good results and even some cures, but there is a danger of diabetic coma. While the Noorden oatmeal and cereal foods fatten the patient, here, again, œdema may supervene. We try it sometimes for a few days in the week. Guelpa proposed hydrothera-

peutics, under which sugar decreases rapidly, so that it also can be tried for a short time with care.

Now we come to the so-called "Scientific" cure, which is based upon the urinary analysis, but as this requires frequent weighing of the food and of the patient, it is not very practicable, and leads sometimes to neurasthenia, from the patient's introspective observation of the frequently repeated procedures.

Our proposition is, that the average diabetic patient should consume thirty calories per kilogramme of his weight every twenty-four hours. First, put him on a milk diet for three days, weigh him, and estimate the proper dosage of nitrogen in total quantity. For example, suppose that a man one meter seventy in height weighs ninety-five kilogrammes (properly he should not weigh more than, say, seventy-two kilogrammes, which is equal to 2160 calories) and that he gives about 1625 of nitrogen, then 360 grammes of meat and 60 grammes of cheese are quite enough for his nitrogen needs. Put him, then, on only a little less than two quarts of milk per day for three days, and suppress all the sugar-producing foods; give very little bread and then only the soft part; let him have 300 grammes of potatoes and all the animal foods he likes, as well as fish, eggs, green vegetables, fats, butter, and oils—even cod liver oil in weak subjects—and you have the proper diet. We also allow apples, peaches, and a little wine, and infusions of cinchona bark or geranium leaves. We feel that in all cases our efforts are palliative only, since a specific cure is impossible. Taking, for example, a corpulent diabetic: good results are obtained first, by an exclusive milk diet for three days, one pint the first day, increasing gradually up to two quarts, then start the above diabetic regimen.

Here is an illustrative case: A man who was losing 25 to 30 grammes of sugar received nothing but water the first day, and then the graded milk diet for the three days. At first the sugar seemed to increase, but it gradually came down, and with our diet reached zero in a few weeks. While the sugar increases a little the first three days of the milk diet, after that it decreases. If, in spite of this, the sugar persists, we add the following medication:

R—	Gm.
Phenazone	1
Sod. Bicarbonat. aa	1
M.—Sig.—Take during the day in divided doses, in Seidlitz water.	

In one case the sugar was reduced by one-half after the third day, and this is the rule with this medication.

Take a second patient of ours: Here is a diabetic who had 5840 grammes of urine only, with a specific gravity of 1041, which gave 376 grammes of sugar! With phenazone for three days and the diet, the urine was reduced to 1750 grammes, the specific gravity to 1030, and the sugar to 114.

Phenazone may be tried, when there is no albumin in the urine, or no great weakness or depression. In the presence of these complications, we omit the phenazone. Otherwise, we give as much as two grammes a day for a few days—say three days, and on the fourth day, 40 centigrammes of quinine, and a wafer daily as follows:

R—	Gm. or C.cm
Sod. Arseniat. ....	.006
Lithii Carbonat. ....	.12
Codeine ....	.006
Theriacque	
Ext. Cinchonæ	aa .12
M.—Fiat-Wafer.	
Sig.—One wafer twice a day for three weeks.	

Another diabetic received phenazone, and the sugar was reduced from 313 grammes to 100 by the third day.

In some cases we give brewer's yeast, and add four grammes of tartrate of potash and soda as a laxative. In the nervous cases we recommend three grammes of the bromide of potash daily, or else the following pill:

R—	Gm. or C.cm.
Ext. Opii ....	.03
Ext. Belladonnæ ....	.006
Ext. Valerian. ....	.2
M.—For one pill.	
Sig.—Four pills a day, increasing up to eight, and then decreasing again to the four a day.	

This is stopped so soon as possible, and the wafers of the arsenic and lithium carbonate are given.

As to hydrotherapy and electricity, high frequency cure is not useful, unless there is a very high arterial tension. Bene-Barde recommends a sedative douche at 33 to 37 degrees C. to increase reaction, and it suffices in some nervous cases. In all cases it should be of very brief duration, however, and we do not insist on it.

Mineral water cures abound in all parts of the world. In France, we find that Vichy is the best station for diabetics, and in particular for the corpulent ones. The arthritic cases, who are producing gravel, are sent to the diuretic waters of Contrexeville and Vittel, or Martigny. The anæmic cases do well at the arsenical waters such as La Bourboule, Royat, and Rheinfelden, and the salines are useful in weak patients. Sea baths may be indulged in in a mild climate. Nervous patients do not sleep well at certain seaside resorts on the Mediterranean Sea, and the Atlantic Ocean is usually too cold for these cases.

As to climate: The Winterild sunny resorts are beneficial for diabetics whose skin is sluggish and for whom mild climates, such as Nice and the whole Riviera, are indicated.

We may conclude by saying that there is no specific cure, and the therapeutics of diabetes consists in using different forms of cure according to the cases. Each patient must be treated in accordance with his individual requirements.

HYPODERMOCLYSIS IN THE TREATMENT OF ACUTE INFECTIONS

BY R. MAX GOEPP, M.D.

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HYPDERMOCLYSIS is the introduction under the skin, by means of a hollow needle, of water containing salts or other soluble substances in varying proportions. Unless otherwise specified, physiologic salt solution,—i.e., sterile water containing 0.6 of one per cent. of sodium chloride,—is understood. The term is not used to designate the hypodermic administration of medicinally active solutions, such as salvarsan, even when greatly diluted. This definition, it will be observed, does not specify the temperature of the solution, dosage, method and rate of introduction, and other factors that enter into the physiologic and therapeutic actions of the procedure. Rightly employed, with due regard to the indications, hypodermoclysis is a therapeutic procedure of approved value in many acute and chronic conditions; but it must be used with a full understanding of its physiologic action and a clear appreciation of the object to be accomplished, as well as the contra-indications that may be present in the individual case.

Hypodermoclysis is of comparatively recent date, particularly in the treatment of any but surgical conditions. At first only small quantities of fluid were injected, not more than 200 to 300 cubic centimetres; the employment of single large doses, a litre or more, which is the common practice in surgery, came later. In this connection it may be noted that experiments on animals are reported which show that during hemorrhage repeated small injections tend to favor spontaneous hæmostasis, while the introduction of a large amount at one time has the opposite effect; in other words, it is stated that the coagulability of the blood is increased by a small or moderate injection of saline solution.

Other substances besides sodium chloride, such as sodium bicarbonate in much larger proportion in the presence of acidosis; solutions

of lævulose; and, quite recently, sea-water diluted to the concentration of blood-serum, have been employed; but in this article I shall confine myself to the consideration of physiologic, so-called normal salt solution, of 0.6 per cent. strength, or, according to von Kryger (in Penzoldt's "*Klinische Arznei Behandlung*"), 0.9 per cent., as this proportion is more nearly isotonic with blood-serum. With reference to the sea-water treatment of enterocolitis in children, constipation, skin diseases, and a heterogeneous assortment of other ailments, which was exploited several years ago, after experimenting with the method in about twenty cases of chronic disease, chiefly eczema and various gastro-intestinal disturbances, including one case of typhoid fever with severe toxæmia, in which the results were excellent, I am convinced that sea-water introduced subcutaneously does not differ in its effects from saline solution prepared in the ordinary way, and I was not able to confirm the remarkable claims that have been made for this treatment in chronic conditions.

The most important single factor in the use of hypodermoclysis in acute infections is the quantity employed at each injection, and, next to that, the intervals between injections. While a considerable latitude may be allowed in the dosage, very large quantities, such as are usually given after severe hemorrhage, are never indicated in acute general infections, in which the functional integrity of the cardiovascular apparatus is of paramount importance. Before discussing this question in detail, it is, however, proper to take up the physiologic action of the procedure.

Temperature of the Solution.—While it is the usual practice to maintain the injected solution as nearly as possible at the temperature of the body, the fluid is introduced so slowly that a variation of a few degrees higher or lower is probably neutralized by the time the fluid is absorbed. I have frequently injected saline solution at ordinary room temperature, and have never noted any untoward results.

Physiologic Action.—The literature contains but little systematic research work on hypodermoclysis. The subject is covered rather fully by L. Fourmeaux ("*Des Injections Sous-cutanées Massives de Solutions Salines*," Paris, 1897) from the experimental as well as the clinical standpoint, and I have gleaned some of the facts from his monograph.

When a quantity of saline solution is injected under the skin, the

fluid is taken up by the lymphatic vessels and rapidly absorbed into the general circulation. Unless solutions of higher concentration are used, the osmotic pressure is not affected, and thus irritation is avoided. An obvious and immediate effect is to increase the arterial tension, which is particularly marked when the blood-pressure has been previously low. The second most important effect is manifested on the urinary excretion of water, which is increased in proportion to the quantity of fluid injected, provided the kidneys are functioning normally. Elimination through the kidneys equals the intake except for a very small proportion, which is accounted for by the other emunctories, the bowel, skin, and lungs. Experimentally it has been found that a healthy animal can withstand the introduction of comparatively enormous quantities of salt solution. Fourmeaux injected 1670 grammes into an animal weighing 2900 grammes, or $57\frac{1}{2}$ per cent, which is equivalent to about 85 pounds, or over 40 quarts to a man weighing 150 pounds. The fluid accumulates in the serous cavities, the lungs, the spleen, the liver (both of which become temporarily greatly enlarged), and the bone-marrow, to be completely eliminated after the injection is stopped.

The *pulse* becomes stronger and fuller, in keeping with the increase in blood-pressure. Arrhythmias are said to be influenced favorably.

Blood.—Hæmolysis does not take place, but the erythrocytes swell up, become crenated, pale, and finally disappear from the blood picture. The number of leucocytes is diminished, but no change in the proportions of the various types is reported. The diminution is especially noticeable in acute infections which normally show leucocytosis. The hæmostatic effect of small injections of saline solution is explained by Fourmeaux on the theory that, owing to the rapid removal of the adult red cells, the entrance of normoblasts into the general circulation is hastened, and the fibrin liberated by these elements increases the coagulating power of the blood.

Kidneys and Urine.—The diuresis does not set in at once, and, when repeated injections are given, begins to be marked after the second injection. The specific gravity of the urine is lowered almost to that of water, 1005 and 1002 being commonly observed; the urine becomes pale, and an increase in the total output of urea and of chlorides is noted. Hæmoglobinuria has been observed.

Lungs.—A temporary œdema is said by Fourmeaux to be the rule when large quantities are injected. The râles disappear in a short time, and there are no subjective symptoms.

Temperature.—It is well known that hypodermoclysis is frequently followed by a rise in temperature. In afebrile subjects there is at first a slight drop, followed by a rise of rarely more than 2° F. at the most, the maximum being reached in about three hours. The temperature gradually returns to normal. Sometimes the fever is preceded by a chill. The latter is more often observed in febrile patients, and the initial drop may take on the proportions of collapse.

Spleen.—The swelling of the spleen, which has been noted in animals post-mortem, may register itself clinically by pain in the left side.

Skin.—The sweating begins later than the diuresis, and the secretion of the sudoriferous glands becomes neutral and rich in salt.

Nervous System.—Some patients exhibit mild excitement and become excessively talkative. Delirium is said to occur rarely.

Accidents.—Among the minor accidents and unpleasant secondary effects of hypodermoclysis we may enumerate excessive temperature reaction, stitch in the left side, headache and giddiness, and a transient hæmoglobinuria. Except the first, none of these phenomena has come under my personal observation. I have occasionally observed a slight pulmonary œdema which I thought might be attributed to the hypodermoclysis, but, as it was always in patients who were gravely ill, it was impossible to determine the cause of the phenomenon with absolute certainty. Its occurrence is always an indication for stopping the injections.

The dangerous complications which must be avoided are pulmonary œdema, œdema in other portions of the body, and dilatation of the heart. As this organ is more or less involved in any acute general infection, and above all in pneumonia, the integrity of the heart and of the vasomotor system must be safeguarded. This can be done by observing two important rules: *First*, to inject not more than 300 cubic centimetres at intervals of twenty-four, twelve, or at most eight hours, and to inject slowly; *second*, to begin the administration of saline solution early in the attack and stop the injections at the first sign of circulatory embarrassment.

Indications for Hypodermoclysis in Acute Infections.—There

are two conspicuous features common to all infections: a lowered blood-pressure, most typically seen in pneumonia, and toxæmia. We have, therefore, two definite therapeutic indications, both of which are met by the judicious use of hypodermoclysis, in a manner which follows logically from a consideration of the physiologic action. Whether there is, in addition, any specific action on the immunizing powers of the organism,—that is, the production of antitoxins or bacteriotropins,—or on the process of phagocytosis, is a question that for the present remains purely speculative. There appear to be no experimental facts to support or refute such an hypothesis. It seems at least possible that the general stimulation of the circulation and the dilution of the blood may facilitate the migration of leucocytes and stimulate their phagocytic activity. All that can be said with certainty is that hypodermoclysis improves the vasomotor tone by keeping the blood-vessels filled and maintaining a constant, gentle stimulation of the circulation in a manner similar to its action in combating surgical shock, and that it increases the urinary output and the elimination of toxins through the kidneys.

While it may be employed with advantage in any acute general infection, it finds its greatest field of usefulness in general sepsis, especially puerperal infection, in lobar pneumonia, and in typhoid fever. It is also employed with good results in Asiatic cholera, in which the extreme dehydration of the tissues furnishes an urgent indication, which cannot be met by any other method of introducing water into the system.

Contra-indications.—In puerperal sepsis, especially, the possibility of thrombosis must be borne in mind, hence in the presence of phlebitis the procedure is unsafe. Apoplexy is mentioned because it may be mistaken for uræmia, in which hypodermoclysis naturally suggests itself. Advanced Bright's disease, arteriosclerosis, cirrhosis of the liver, grave anæmia, and, of course, cardiac failure, whether due to valvular or myocardial disease, contra-indicate the procedure. If, however, the precautions which have been mentioned are observed, the mere existence of a heart lesion need not deter the physician from employing hypodermoclysis when the indications are clear.

Technic.—Hypodermoclysis is such a familiar procedure that a description of the technic is unnecessary. There is one point, however, that I would like to bring out. When injections are to be given

routinely for several days in succession, it is important to reduce the patient's discomfort to a minimum. We should therefore select a part of the body that is not too sensitive and is affected as little as possible by pressure either of the bedclothes or of the limbs as the patient moves about. Moreover, it is a fact, for which I can vouch from personal experience, that the first injection at a given site is more painful than subsequent ones in the same spot, and the latter are also more quickly absorbed. A convenient site for giving repeated injections is the loose tissue over the lower part of the axilla in the region of the seventh to the ninth ribs, which is not exposed to the rubbing or the weight of the bedclothes as the patient lies on his back. The injections may be given alternately in each side, the needle being inserted after the first puncture within about an inch of the previous one. The fluid must be introduced slowly, at least half an hour being allowed for 300 cubic centimetres, and care must be taken that the needle be inserted well into the subcutaneous tissue, to avoid skin necrosis.

It may be asked, How long should the treatment by hypodermoclysis be kept up in a given case? Aside from the general improvement in the patient's condition and the special improvement in the circulation, the best criterion is the daily quantity of urine. If hypodermoclysis is begun at once, whenever the gravity of the condition appears to justify its employment, and the injections are discontinued so soon as the daily quantity of urine reaches 2000 cubic centimetres, the best results will be obtained and all danger to the heart will be avoided. Thus it is rare that the injections need be continued without interruption more than three or four days at a time, although during a long illness, as in cases of typhoid, it may be used repeatedly with advantage. In pneumonia it is particularly important to begin the injections early, in order to combat the toxæmia before its harmful effects on the circulation have begun.

It is often objected that hypodermoclysis is unnecessary and, therefore, in view of the suffering which it entails, unjustifiable, since the same results can be accomplished by similar methods of introducing water into the body. Instead of introducing the fluid under the skin, the patient should be made to drink a corresponding quantity of water, or the salt solution should be introduced *per rectum* after Murphy's drop method. As to the first proposal, I need only quote

the old saying, "You may drive a horse to water, but you can't make him drink." If a patient is able to drink enough water to affect the urinary elimination appreciably, he is not a fit subject for hypodermoclysis: he is not sick enough to need it. As to enteroclysis, its value is well established and, if it be successful, it is a perfectly adequate substitute for hypodermoclysis. But, in the first place, many patients do not absorb even a small quantity of water by the bowel; others find the procedure very irksome and that it interferes with rest; the technic is by no means easy, and requires a skilful and experienced nurse; it is not always possible to be sure that the fluid has really been absorbed, and in any case the physician must depend on the nurse's statement. Finally, clinical experience has not shown me that enteroclysis, even when apparently successful, is as efficacious in combating toxæmia as the subcutaneous route. In private practice it is quite possible for the physician to administer the saline solution in person, or at least see that it is administered under his eye when he makes his visit, and he is then sure that the patient has actually received the treatment. For these reasons it seems to me that the discomfort entailed by hypodermoclysis is worth while, and, moreover, the patient is very often so stuporous that the question of suffering becomes negligible.

Conclusions.—Hypodermoclysis is a valuable therapeutic procedure in the treatment of acute infections. It is a method that can be readily employed in both hospital and private practice and one that does not necessarily require the services of trained assistants or nurses. Dosage and intervals between injections must be adapted to the indications in the individual case. The good effects are obtained by detoxication and by raising the vasomotor tone. The concrete evidence of the efficacy of hypodermoclysis is an increased urinary output.

Medicine

THE NATURE AND SUCCESSFUL TREATMENT OF RHEUMATOID ARTHRITIS

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IN two previous communications¹ the writer has set forth at some length the details of a laboratory and clinical study of rheumatoid arthritis, and a method of successful treatment based upon these findings. Those reports were necessarily lengthy, and the writer herewith presents in brief and simple form, adapted to clinical use, the principles and the essential facts available at the present stage of investigation. While certain features are sufficiently well established to permit of a successful therapy based upon them, the whole matter is still under development. It should also be stated that, however great an effort be made to keep the discussion free from technicalities outside of the practice and experience of most physicians, some consideration of them is essential to a proper presentation and understanding of the case. A short account of the reasoning which led up to the present conceptions may lead to a clearer understanding.

The writer had observed in certain instances the subjective benefit experienced by sufferers from rheumatoid arthritis after major operations and under certain other circumstances. It had also been noted by various observers that arsenic, thyroid extract, and the exposure to the X-ray were sometimes helpful. A study of the metabolism in such cases under X-ray showed an increase in the elimination of nitrogen in the urine, which is also a feature of thyroid administration, and, to some degree, of that of arsenic. A consideration of the above facts, and certain other data which can be omitted for brevity, led to the following hypothesis:

If agents which hasten the general body metabolism, as evidenced

¹ *Amer. Jour. Med. Sci.*, Oct., 1912, and Dec., 1913, No. 6, vol. cxlvi, p. 895; continued as follows: Jan., 1914, No. 1, vol. cxlvii, p. 111; Feb., 1914, No. 2, p. 265; Mar., 1914, No. 3, p. 423.

by the nitrogenous interchange, are helpful in this condition, it is possible that the subjective benefits after operations are due to the lowered demands put upon the body by the depleted diet before and after operation; and in lesser degree to the "destructive" metabolism or catabolism which results when the body utilizes its own tissues for support, as seen in its final expression during starvation. If this be true, it is conceivable that there may exist a midway point at which the economy is able to utilize the carbohydrates and proteids necessary for its bare sustenance without injury to itself, as evidenced in joint disease.

On the basis of this hypothesis treatment was attempted in a series of cases which, within certain wide limits and with adaptations necessary to each individual case, proved the correctness of the principles under consideration so far as they have been developed. It may be well here to present the final conclusions reached, in order that they may be discussed.

CONCLUSIONS

1. Rheumatoid arthritis is apparently a preventable disease.
2. In most instances, except where the general health is undermined by great deformities and sequelæ of long standing, the disease can be arrested.
3. For clinical purposes at least it seems to belong in the category with diabetes and gout, in that there is in each case a limit of toleration for carbohydrates on the one hand and proteids on the other. The rôle of the fats is not yet entirely clear, but they may prove to be borne analogous to the carbohydrates and proteids.
4. After arrest of the arthritis the diet can generally be gradually increased until in some cases it differs but little from that of health.
5. Both hypertrophic and atrophic arthritis respond to these measures, and their common etiology seems probable.
6. The presence of an intercurrent or possibly causative infection is not necessarily a contra-indication to treatment, and recovery may take place in spite of it, though such factors should be eliminated if possible. *The large group of cases in which a causal source of infection cannot be found or removed lends itself particularly to these measures.*

7. Care is necessary to determine the highest level of metabolic equilibrium at which the arthritis will subside, and the patient should be maintained at or near that point.

8. While the general health improves with the subsidence of the arthritis, and though the patients seem to acquire a toleration for a larger dietary, the general principles above described must be rigidly observed or relapse will occur.

9. The disease is apparently not due to faulty elimination through the bowels or kidneys.

10. It is clearly not due to "intestinal putrefaction" so called. There is no reason to exclude proteid in dietary treatment, except in the sense above described, and the ordinary carbohydrate foodstuffs are also clearly capable of causing the disease.

Paragraph 2 may first be taken up, as it is important to recognize that certain individuals are not suitable subjects for these methods.

It is rarely, if ever, that a case will be met in which no influence upon the disease can be observed, but it may well happen that a case may be so severe and of such long duration that the dietary *régime* necessary to accomplish anything may be more than the individual can stand.

Again, even short of this point, the same difficulty may ensue in individuals suffering from some complication such as cardiac disease, great nervous instability, or marked anæmia, and even old age may prevent that response on the part of nature when the load is removed, which is the basis of treatment. The author has had to terminate treatment sometimes when it was apparently otherwise successful because of the development of serious symptoms from totally different and independent sources.

It must not be understood that there is danger in these methods, *per se*, if they be properly watched and controlled, as the author has had abundant proof of the advanced degree to which they can be pushed, but active supervision and minute attention to detail are absolutely necessary to avoid possible injury.

MANNER OF TREATMENT

It is the practice of the writer, upon receiving a patient, to keep a complete record, in grammes and cubic centimetres, of all that the patient eats over a period of about a week. It is sometimes sufficient

to keep this record in terms of tablespoonfuls, teaspoonfuls, glasses, etc., but in severe cases this does not answer. The former is not a very difficult matter in the hands of an intelligent nurse, and is essential for accurate estimation of the amount of food in calories which the patient ingests under the normal conditions of existence.

As indicated in the conclusions, a definite level of food reduction must be reached, differing in each case, before the disease can be affected, and it is essential to know what the normal intake is before this can be done. For example, in one patient weighing 199 pounds the food intake might reasonably have been supposed to be high, but an estimation showed that she ingested only 2000 calories each 24 hours, and that a reduction must be made considerably below that figure, as a starting point, before any results could be expected.

There are plenty of tables from which an approximation of the caloric value can be made, the most convenient being probably "Food Values," by Edwin A. Locke, which contains tables of the equivalents of nearly all articles of diet in calories, metric system and ordinary table measures.* Having obtained an idea of the minimum amount of food the patient is taking, a new diet can be made out on this basis, which must be definitely lower than the other. It should also be as high as possible, provided it accomplish the purpose intended, as a further reduction is unnecessary and may do harm.

There is as yet no exact way of determining this point. In general, it may be said that a recent case in a young subject requires a slight modification as compared with an advanced case of long standing, and if the average normal food intake be found high, it may be assumed with fair probability that the new diet need not be very restricted. On the other hand, if the average food intake be found low, it is obviously necessary to strike an even lower level. In general, it is better to reach the lowest level necessary at once, and work up rather than the reverse, as in the latter case the individual may for some time remain upon a restricted intake to no purpose and with possible injury or loss of weight.

From purely scientific considerations, the nature of the diet is important, provided its total caloric value be correct, but in practice this is not sufficient, as people are not machines and require food which is not only nutritious but also palatable. Otherwise they find

* See page 84.

great difficulty in coöperating in the manner required for ultimate success.

Thus there are many articles of diet whose bulk is considerable for the food value contained, and that serve the several purposes of filling the stomach, providing saliva, and affording the psychic satisfaction of eating when hunger is present.

Such foods are apples, tomatoes, spinach, celery, beets, cabbage, turnips, lettuce, and others, and can be used to take the edge off the appetite and serve as a basis for the really nutritive but restricted articles which follow. It is not yet positively determined whether the fats can be tolerated in like manner as the carbohydrates and proteids, but there is good ground for suspicion that this is the case, and, in any event, they are less important as foodstuffs and need not figure largely unless desired. The author uses fat in the shape of butter quite freely as part of the necessary caloric quota, and also in the shape of olive oil in mayonnaise and French dressing so necessary to make lettuce palatable.

As for the carbohydrates and proteids, it is immaterial how they be administered within the given caloric total, though a nearly exact estimation is easier if they be simply prepared. For example, there is great difficulty in allowing for the fat in fried articles, and these should therefore be avoided. So, too, cream gravies or dressings are objectionable for similar reasons. Until convalescence is well under way, it is best to adhere to the simple staples, such as bread, butter, sugar, milk, roast, broiled, or boiled meat and fish, rice, boiled or roasted potatoes, etc. No one diet can be chosen that is suitable to all cases, for the reasons given above, but in illustration the following may be cited as the dietary in the severe case of a young girl of 20 (Case XV of the series previously reported).

Breakfast: 1 apple (135 grammes), 1 egg (54 grammes), toast (15 grammes), butter (10 grammes), 1 cup weak coffee with teaspoonful sugar (3i), and 2 tablespoonfuls of 20 per cent. cream (3viii).

Dinner: Strained tomato soup (3iv), spinach (100 grammes), or asparagus (100 grammes), with raw celery, cucumbers, 1 raw tomato, stewed fruit without sugar (63 grammes).

Supper: White meat of chicken, or fish, or chop, or beefsteak (125 grammes), stewed figs, 2 tablespoonfuls (63 grammes), weak

tea with $\frac{3}{4}$ iv of 20 per cent. cream (1 tablespoonful) and 1 teaspoonful (3i) sugar.

Bedtime: 1 glass of milk and 1 tablespoonful of 20 per cent. cream.

It is quite impossible, in the short space available for the present article, to give detailed descriptions necessary for the successful treatment of all cases. It is rather the purpose of the writer to emphasize the easy practicability of these methods in the hands of any practitioner who will take the trouble to work out the diets as indicated, and who will give the case throughout the same scrupulous care as to a severe pneumonia pending the crisis. For a full presentation of the subject the reader must consult the reference at the beginning of this paper.

There have been conducted in conjunction with the present work many laboratory studies which were essential to the expansion and verification of the original hypothesis and to later developments, but reference to these is now omitted as beyond the scope of this article.

Further laboratory studies are now under way, and a considerable series of cases has been treated since the report of those previously published, in which the availability of these methods to the treatment of rheumatoid arthritis is additionally substantiated. These cases, which were abandoned by other physicians, will be reported in detail upon the completion of the studies now pending, together with later reports on the condition of the cases previously mentioned, so far as this can be ascertained.

The author wishes to anticipate failure on the part of some who may undertake this treatment because of a lack of accuracy and care in conducting it. Haphazard and careless methods will not only fall short of success, but may work real injury. It is no more possible successfully to carry out the principles outlined above without minute attention to detail than it is to treat diabetes, with justice to the patient, without careful estimation of the carbohydrate administered, and of the daily amount of sugar in 24-hour specimens of urine.

The writer has already had the experience above suggested in two cases referred by physicians, at considerable distance, who had unsuccessfully attempted to apply the principles described. They were good enough to acknowledge that they had not given the care

to the matter which they knew it demanded, and the same cases later responded completely in the hands of the writer. These cases had been given "diets" taken bodily from other cases described in the reports; which diets were unsuited to them, and in every case required alteration.

In conclusion the writer would like again to emphasize that there is nothing in the management of cases along these lines beyond the capacity of any practitioner of medicine who will give to it that attention which modern considerations of diet demand in any event. Such attention, for example, is necessary to-day in the intelligent treatment of typhoid fever and in the practice of pædiatrics.

If the truth of this can be made clear, and if other physicians may be led to institute treatment on some of the countless cases of this omnipresent disease, always bearing in mind the necessity of doing it thoroughly or not at all, the writer will feel that the purpose of this explanatory effort will have been in some part accomplished.

MALARIA CARRIERS

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PARASITISM AND CARRIERS

A PARASITE may be defined as a living organism which, for the purpose of obtaining food, takes quarters, temporarily or permanently, on or within another living organism.

Parasitism is practically universal in the animal kingdom; there is no species of animal and no race of man known to be free from parasites. Man serves as host for a greater variety of parasites than any other member of the animal kingdom, and many of his parasites serve in turn as hosts for parasites; or, as an old doggerel puts it:

Big bugs have little bugs
Upon their backs to bite 'em,
And little bugs have lesser bugs
And so *ad infinitum*.

Parasites may be classified as occasional and permanent. Occasional parasites seek their host only preparatory to abstracting food, and quit him after accomplishing the purpose. Permanent parasites, on the other hand, obtain shelter as well as food from the host, and most of them inhabit internal organs. Thus the flea, the bedbug, and the leech are occasional parasites of man, while the tapeworm and the *Amæba histolytica* are permanent parasites. For the production of malaria, then, two parasites of man are concerned, one of which is parasitic to the other; one, the mosquito, being an occasional parasite, the other, the malaria organism, a permanent parasite to both man and the mosquito.

One of the most important, if indeed not *the* most important, phases of parasitism is the condition in which the subject is known as a carrier. By the term carrier we mean an individual who is serving as host to pathogenic parasites without having evidences of disease due to such parasites. Acute carriers are those persons harboring the germs for a short time after recovery from an infectious

disease. Individuals fostering parasites indefinitely are called chronic carriers. A temporary carrier is one who receives and discharges pathogenic organisms for a brief period without ever having had the disease.

One of the most vital innovations in modern preventive medicine is the change in our conception of the method of propagation of many of the infectious diseases. We used to think that the furniture, walls, books, clothing, and pictures gave us diseases long after the original case was forgotten, unless the premises had been fumigated with malodorous drugs. But we are learning better. Boards of health in certain of our cities now have the courage to run counter to popular superstition and dispense with disinfection after many cases of diphtheria, scarlet fever, and measles. We have come to recognize as the source of danger not these inanimate objects, but the person who has recently or even remotely recovered from one of these diseases. Instead of expensive disinfection of premises, attention is now diverted to the sterilization of the carrier. So important is this carrier question that the effective prevention of many infectious diseases may be said to stand or fall with the control of germ carriers.

Owing to the present-day activity of that great common carrier, the railroad, the disease carrier is not a local but a national problem. Many a public water supply has been polluted by a typhoid carrier on a train coursing through a water-shed.

Carriers of typhoid fever have received much attention recently. The most celebrated of these was "Typhoid Mary," the "Bloody Mary" of the history of preventive medicine. This woman, a cook, was responsible for at least twenty-eight cases and one death from typhoid fever in Maine and New York, and, though she denied ever having had the disease, she was discharging millions of typhoid germs daily. She was held in custody at the New York detention hospital for many months. This case is cited in Europe as a brilliant instance of forethought and care on the part of the State.

In the fall of 1909 an epidemic of typhoid fever occurred in New York City, the total number of cases finally reaching several hundred. This epidemic was kindled by a dairyman, who had typhoid fever forty-six years previously, and still harbored and discharged the germs.¹

A typhoid carrier who was proved responsible for twenty-eight cases, including four deaths, was recently detained under custody in

San Francisco for seven months, when he was rendered sterile with autogenous vaccine.²

The list of such cases is a long one. It has been shown by recent investigations that three per cent. of all persons convalescing from typhoid fever become bacillus carriers,³ and it is estimated that one-fourth of the typhoid carriers have never had the disease.⁴

It is calculated that there are, in the city of Washington alone, more than three hundred typhoid carriers, and that in New York City there are about ten thousand.⁵

Gall-bladders have been removed in order to sterilize carriers of typhoid, and in Germany a prize of \$2500 has recently been offered to the person of any nationality devising a method of accomplishing this result.⁶

Nor is typhoid fever the only disease in which the carrier presents an important public health problem. It was really in diphtheria that the true danger of carriers was first appreciated.

Sobernheim gives a table showing that of 1832 persons examined for diphtheria bacilli in Berlin in 1910 to 1911 positive results were found in 244 healthy persons, or 13.3 per cent.⁷

It is stated that one per cent. of the population at large of our country are diphtheria carriers.⁴

Other diseases in which the carrier plays an important rôle are pneumonia, bacillary dysentery, paratyphoid fever, cerebrospinal meningitis, cholera, poliomyelitis, gonorrhoea, and streptococcus infections.

Of diseases due to animal parasites in this country which produce carriers, the chief are amœbic dysentery, uncinariasis, and malaria.

MALARIA CARRIERS

Our definition of a carrier must be amplified slightly to apply with accuracy to malaria. Not every person who serves as host to malaria parasites without having evidences of malarial disease can be said, in the strict sense, to be a malaria carrier. There are two additional conditions essential. The first of these is that the sexual form of the parasite must be present in the blood. The explanation of this is evident when it is recalled that only the sexual form develops in the body of the mosquito. The second condition is that the sexual form of the parasite, the gamete, must exist in sufficient numbers. This has been determined by the investigations of Darling,⁸ who compared the number of gametes with the number of leucocytes. The

lower limit of infectivity was determined as being near one gamete per every 500 leucocytes, or 12 gametes per cubic millimetre of blood, and persons with more than this must be regarded as gamete carriers.

To these two conditions must be added two further probable ones: that the gametes be in the proper state of maturity and in suitable proportion of sexes.⁹

It should be borne in mind that man is merely the intermediate host of the malaria organism, and that the mosquito is the definitive host. It may be said that man gives malaria to the mosquito, and not the mosquito to man. Viewed in this light, man is made use of by Nature to serve as a depository for the interchange of the parasite from one mosquito to another. Man is naturally a better host for these parasites than the mosquito. In the blood of a human being the environment is more constant than in the changing temperature of the cold-blooded mosquito. The life of man is more certain and longer than that of the mosquito, and the pabulum he furnishes is more extensive. On the other hand, while the infected man usually takes far too little quinine, the mosquito takes none at all.

In order to appreciate the true significance of the malaria carrier, a sharp distinction between malarial *infection* and malarial *disease* must be drawn.

The difference is expressed by *symptoms*. It is a general rule of parasitism that the parasite, being smaller and weaker than its host, makes no attempt to jeopardize the life of the latter, as its own welfare would thereby be endangered. The parasite usually partakes sparingly of the host's larder, and so long as it does this it is allowed to remain undisturbed. When, however, it becomes so greedy or when it reproduces so rapidly that simple infestation becomes disease, either the host or the parasite or both are in danger. So long as a man's parasites do not inconvenience him, he tolerates them. Mere infection implies a supply of vital resistance equal to the demand; disease denotes an exhaustion of this supply. Infection is an antagonistic equilibrium between parasite and host; disease a rupture of equilibrium. Infection is a conflict; disease a conquest. The relation between infection and disease may be fitly compared to that existing between a compensated heart lesion and broken compensation.

The relationship between the carrier state and latent malaria is close. There is, however, an essential distinction. In latency only asexual forms *may* be present, while in the carrier state sexual forms

must be present. From a public health point of view, however, all subjects of latent malaria should be regarded as potential carriers, even though gametes may not be found on examination.

ETIOLOGY

The geographic distribution of malaria carriers is influenced by (1) the geographic distribution of malaria, (2) the prevalence of immunity, and (3) the proper use of the specific.

Season, which is such a potent factor in the prevalence of malaria, influences also the frequency of carriers. More carriers are, of course, found during and immediately following the malaria season. Furthermore, it is the carrier state which serves as the bridge in the life of the parasite between one season and the next. It will be recalled that it is impossible for the parasite to endure low winter temperature in the body of the mosquito, and but for the warm-blooded hospitality of man the disease would be eradicated spontaneously in many climates.

Rainfall, topography, and inundations bear much the same relationship to the production of carriers that they do in the etiology of malaria.

Altitude is a factor in the distribution of carriers. The following table, compiled by Ross,¹⁰ shows the spleen rate according to various altitudes in Mauritius:

Altitudes in feet.	Children examined.	Spleen rate.
100	5210	49.6
200	4843	46.4
300	3559	37.6
400	2817	49.2
500	1246	36.9
600	830	37.5
700	1963	30.0
800	1398	11.1
900	624	23.4
1000	972	7.3
1100	782	5.8
1200	858	12.4
1300	130	4.6
1400	1991	21.8
1500	612	4.2
1600	112	6.2
1700	....	....
1800	765	3.2

By far the most important factors determining the prevalence of carriers are race and age.

While the various races of mankind vary somewhat in their relation to malarial infection, the negro is preëminently the most frequent carrier of the disease. This may be accounted for by the more frequent exposure of the negro to malaria, and, being relatively immune, he less often resorts to specific treatment of his infection. The immunity of the negro has been variously estimated, some observers maintaining that they are absolutely proof against malarial disease, while others hold that they are as susceptible as the whites. The truth lies between these two extremes. Adult negroes reared in malarial regions are much less liable to paludism, so long as they remain indigenous, than are the whites. The negro does not, however, enjoy an absolute, but only a relative, immunity from malaria.

That immunity is much more manifest in adults than in children will be shown under the consideration of endemic index.

The effect of a change of residence upon malarial immunity is a well-known fact; the change frequently "brings the malaria out." Individuals once immune may become susceptible on returning home from a temporary residence in a malaria-free country. Repeated infection and consequent immunity to one form of malaria do not necessarily protect the individual from the other forms.

The resistance of the black race to malaria is due to repeated attacks in early childhood, and not to any great extent to heredity. While in a sense selection is a factor, it is largely an individual struggle, the selection of the fittest occurring in infancy, and but little being derived from progenitors.

The importance of age as a factor in the dissemination of malaria is so great that the percentage of children infected in a given locality is taken as the index to the prevalence of malaria in that region.

The most accurate method of determining the *index endemicus* of an area is to make a large number of blood examinations of native children at various ages. This requires a great deal of time. It has been repeatedly shown that in regions where malaria prevails extensively, a large percentage of young children harbor the parasites without manifesting any symptoms of the disease, the index decreasing as the age increases. For this reason young natives with latent malaria are the source of the greatest danger to the community.

Malarial infection in some localities seems as normal as flea infestation is to a dog.

In calculating the endemic index, a sufficiently large number of persons must be examined to eliminate the error incident to "random sampling." It has been estimated that if fifty persons be examined and the blood of twenty-five found to contain parasites, the margin of error being 20 per cent., the index would not be 50 per cent., but between 30 and 70 per cent. Furthermore, while a high index indicates widespread malaria, an index of zero must not be construed to indicate an entire absence of the disease, since experience has shown that it may exist where the index, estimated in this manner, is zero.

The presence of splenic enlargement has been employed to calculate the extent of paludism, this method requiring much less time than the examination of the blood. The spleen rate and the endemic index estimated by the microscopic examination of the blood frequently do not correspond even approximately.

Koch ¹¹ records the following indices:

At Bogadjim:

	Per cent. infected.
Children under two years	80.0
Children from two to five years	41.6
Persons over five years	0.

At Bongu:

	Per cent. infected.
Children under two years	100.0
Children from two to five years	46.1
Children from five to ten years	23.5
Persons over ten years	0.

Panse's ¹² observations at Tanga may be tabulated thus:

	Per cent. infected.
Children under one year	48.0
Children from one to three years	87.6
Children from four to seven years	65.1
Older children and youths	39.4
Adults	15.3

Similar results were noted by Schaudinn,¹³ in San Michele di Leme:

1901.	Per cent. infected.
Children under five years	100.0
Children from ten to fifteen years	100.0
Children from five to ten years	83.0
Persons from fifteen to sixty years	0.

1902.	Per cent. infected.
Children under five years	100.0
Children from five to ten years	100.0
Children from ten to fifteen years	83.0
Persons from fifteen to sixty years	7.7

Annett, Dutton, and Elliott ¹⁴ obtained the results recorded in the following tabulation:

	Per cent. infected.
Under one year	27.3
From one to two years	63.0
From two to three years	63.0
From three to four years	51.0
From four to five years	48.8
From five to six years	38.8
From six to seven years	6.6
From seven to eight years	27.5
From eight to nine years	25.0
From nine to ten years	14.0
Ten years and over	10.0

Craig ¹⁵ reports the endemic index about Camp Stotsenburg as follows:

From one to five years	72.5
From five to ten years	37.0
From ten to fifteen years	24.5

Stephens and Christophers ¹⁶ have prepared the following table to illustrate the relation between the spleen rate and the parasite rate:

Locality.	Spleen rate.	Endemic index.
Calcutta	0.0	0.0
Jalpaiguri:		
Bustee children	27.0	16.1
School children	14.7	00.0
Babu children	14.2	0.0
Mainaguri	74.0	25.0
Rungamutty	83.0	43.6
Sam Sing	7.1	16.0
Kurseong I	0.0	0.0
Kurseong II	0.2	0.0

Endemic indices for the United States have been determined in very few instances.

Sims and Warwick ¹⁷ examined the blood of 610 apparently healthy children and adults in Alabama and found that between eight and nine per cent. were infected with malaria.

Surgeon von Ezdorf, of the United Public Health Service, examined the blood of a number of persons in four Southern States. The results were as follows:

	Number examined.	Per cent. infected.
Alabama	664	3.7
Arkansas	802	6.6
North Carolina	3613	8.5
South Carolina	65	12.3

It is a well-established principle of the epidemiology of malaria that in highly malarial localities the endemic index decreases rapidly with the increase in age of the subjects examined, while in moderately infected areas this is not so marked.

As may be inferred from what has been said upon immunity, a high endemic index may not engender a high death-rate, since the frequent infections in childhood produce a relative immunity, whereas in moderately malarial localities immunity is not common, consequently the death-rate may be higher.

The pathogenesis of the carrier state has been the last important aspect of the subject to be cleared up. Even very few theories have been advanced to explain this interesting process, and of these only three will be considered.

1. Feeble schizogonic reproduction in the spleen and elsewhere, too feeble to produce active symptoms, but sufficiently vigorous to prevent complete annihilation of the parasites, which reproduce actively when circumstances are favorable.

2. Intracorpuseular conjugation of young parasites resulting in a zygote stage or resting body.

3. Parthenogenesis, or reproduction by unfertilized macrogametes.

According to the first theory, it was believed that so long as the number of parasites remained below a certain level of asexual reproduction the disease was latent, and when it rose above this level a relapse occurred. Sims¹⁸ estimated the greatest number of adult parasites which the body can endure, without symptoms, as about two billions. While it is probable that brief periods of latency may thus be explained, especially in persons possessing a relative immunity, it is evident that this is not the common mode, since the asexual cycle is known to wear out spontaneously after certain periods.

Intracorpuseular conjugation, the asexual union of young parasites within the red cell, was first observed by Mannaberg, and in this country by Ewing. The latter did not attach much importance to its significance. He says: ¹⁹

"A further inquiry relates to the uniformity with which conjugation occurs, and its position as an essential or as an accidental phenomenon in the progress of malarial infection. It would seem that a process so fundamental as the conjugation of individuals, if it occurs at all, ought to be an invariable feature of every active infection, but there is not sufficient evidence on which to base any such claim. The four cases referred to as furnishing numerous clear examples of conjugation were selected on account of the abundance of the conjugating forms, but in many other cases less numerous, though equally distinct, examples were seen, indicating that the process is of very frequent occurrence. On the other hand, it must be admitted that the majority of specimens from routine cases fail to show any distinct traces of the process; from which it may be concluded that conjugation is probably not an essential feature of the growth of the parasite."

Craig,²⁰ who has probably investigated intracorpuseular conjugation more carefully than anyone else, accepts the process as entirely satisfying the conditions of latency. He concludes:

"1. Intracorpuseular conjugation is the principal cause of the maintenance of malarial infection in man, and its absence the cause of spontaneous recovery.

"2. It maintains malarial infection by producing a 'resting' or zygote stage, remaining dormant or 'latent' until conditions are favorable, when it gives birth to several young plasmodia which, penetrating the red blood-corpuscles, by their growth and sporulation cause a recurrence of the infection."

The strongest argument in favor of intracorpuseular conjugation as a preservative process of the malarial parasite is the fact that conjugation is not uncommon among the protozoa, and, while it is true that it is usually a sexual conjugation, there are instances where sex in the conjugating bodies cannot be differentiated. It is ordinarily observed in these low organisms where reproductive vitality is at a low ebb, and seems to be merely a rejuvenating process by which normal reproduction is invigorated. On the other hand, intracorpuseular conjugation in malaria has been observed most typically

in severe infections, where plural infection of red cells is common, where the organisms seem virulent, and not in those cases where the parasites are scanty and the symptoms slight.

It is my opinion that conjugation in protozoa in general has its analogue in the conjugation of microgamete and macrogamete in the body of anophelene mosquitoes, every step of whose life history has been traced from zygote to sporozoit. That intracorpuseular conjugation occurs in malaria is probable, but its importance in the etiology of latency of long duration is probably minimal. It is, perhaps, merely a rejuvenating process in schizogony, and thus far may have an indirect rôle in brief periods of latency. It seems probable that the product of conjugation is not a "resting body"; at least, such has not been demonstrated, the conjugating bodies having been traced no farther than union. While Craig²⁰ refers to certain large bodies similar to gametes, no relation is established between them and conjugation.

In regard to the significance of intracorpuseular conjugation of malarial parasites, Calkins²¹ has this to say:

"Craig's view is certainly enticing, but we must not forget that plastogamy is a very common phenomenon throughout the group of protozoa, and occurs frequently when there is no subsequent reproduction. It happens in most of the common rhizopods, for example, and has been described for cases of *Arcella*, *Diffugia*, *Centropyxis*, *Amœba*, etc., and it has been shown that these unions have nothing to do with the actual process of fertilization. It is impossible to state that no stimulation whatsoever results from such a plastogamic union, especially if it is followed by nuclear union or karyogamy, according to the account given by Craig; but it is difficult to believe that two widely different processes of fertilization should exist in the same organism."

Minchin²² also doubts the interpretation of this process by Ewing and Wright, and regards it as devoid of reproductive significance.

Parthenogenesis, or reproduction by unfertilized female organisms, is known in many species as *Hæmoproteus*, certain of the rotifera, jelly-fish, worms, entomostracea, acarina, and a number of insects, as the silk moth, mosquito, gall-fly, ant, bee, wasp, chironomus, etc. Among protozoa, where the destruction of life is enormous, and complete annihilation at times seems imminent, it is not surprising that such a mode of reproduction is imperative.

Ever since the discovery of the malarial parasite, the gametes have been regarded as closely allied with chronic malaria and with relapses, being the most resistant forms of the organism. Golgi plainly stated it as his belief that the crescents were the parasites of the fevers recurring at long intervals.

Canalis,²³ in 1889, described and pictured spherical bodies derived from crescents in the act of sporulation.

In 1890 Antolisei and Angelini²⁴ confirmed the observations of Canalis.

Lewkowicz²⁴ reported, in 1897, that he had seen sporulating crescents, some of which contained as many as thirty spores.

None of these observers, however, construed the process as parthenogenetic.

Grassi,²⁵ in 1901, expressed the opinion that the parasites of malaria underwent a parthenogenetic cycle of development whereby the species was perpetuated after the death of the schizonts. He cited a number of arguments in support of the theory, and referred to a similar process in other protozoa, *Adelea*, *Trichospermium*, and *Volvax*.

It was Schaudinn²⁶ who, in 1902, first observed and correctly interpreted parthenogenesis of tertian macrogametes. It is unnecessary to recount the details of these observations here. Suffice it to say that every step in the development of the parasite was followed, and definite relations between its growth and latency and relapse established. Macrogametes were seen to sporulate, producing merozoites, which, in turn, underwent normal schizogony.

Maurer,²⁷ in 1902, observed sporulation of æstivo-autumnal gametes, and construed it as parthenogenesis.

Ziemann²⁸ believes that he has seen parthenogenetic reproduction of quartan gametes.

Blüml and Metz²⁹ observed sporulating macrogametes in six preparations taken from five patients with tertian malaria. The process was identical with that described by Schaudinn. Young and sporulating schizonts and young gametes were present in these same preparations.

Karrewy³⁰ is reported to have confirmed the observations of Schaudinn upon tertian macrogametes.

Finally, Neeb,³¹ in 1910, made a very interesting report upon

parthenogenetic processes in female crescent bodies obtained from the blood of a chronic malarial subject. The specimens were shown to Prowazek and to Nocht, who confirmed the opinion that they were sporulating macrogametes.

A similar parthenogenetic process, observed among the trypanosomes, particularly *Trypanosoma gambiense* and *Trypanosoma lewisi*, should be referred to.

It appears to me that parthenogenesis, first observed and construed by the most eminent protozoölogist the world has ever produced and whose observations have been repeatedly confirmed, must be accepted as the true explanation of chronic malaria, including latency and the carrier state.

SYMPTOMS

The very definition of the carrier state establishes an absence of symptoms, and it has been explained that the production of symptoms endangers the life of the parasite, since these symptoms may lead to treatment. There may be more or less anæmia and splenic enlargement, but even these, which are frequently lacking, are probably due in greater part to past malarial disease rather than to existing infestation. The symptomless carrier state is one of balanced parasitism; there is neither conflict nor conquest: the host has become accustomed to his parasites.

DIAGNOSIS

While there are two methods of recognizing carriers—the spleen and the blood—it is only by laboratory means that carriers may be positively identified. As previously stated, to determine absolutely that a subject is a carrier, the blood must contain gametes, and the gametes must exist in ample number and probably also in a suitable proportion of sexes. However, it is safest, from the public health standpoint, to regard a host harboring any form of malaria parasites in any number as a potential carrier of malaria, for subsequent sporulations may materially alter the inhabitants of the blood stream.

PREVENTION AND TREATMENT

The prevention of carriers depends, first of all, upon the prevention of malaria; secondly, and most relevant to the present discussion, upon the perfection of radical cures of malaria.

Universal quinine prophylaxis is impossible to enforce. Discriminative quinine prophylaxis, considering only cases and carriers, is almost as difficult for these reasons:

1. Many cases are not seen by physicians.
2. Radical cures are not effected.
3. Carriers are difficult to determine.
4. Carriers are difficult to sterilize.

The fact that the malaria parasite has a double chance for life, in the blood of man and in the body of the mosquito, renders early, appropriate, and thorough treatment at least doubly imperative.

The physician who neglects this kind of treatment of all such cases that come under his care subjects not only his patient to the liability of relapse, but also the community to a dangerous carrier, often of more economic significance than a case of smallpox. Such a physician is, although oftentimes unwittingly, treating his patient with no more consideration of his future welfare than the charlatan who pretends to cure syphilis in a few weeks. A few days' treatment with quinine cures malaria no better than three weeks' rubbing with mercury cures syphilis.

The prevention and cure of carriers is accomplished by the same process. After treating the acute attack in the usual manner, fifteen grains of quinine, preferably the dihydrochloride, are given (in three-grain doses every three hours until five doses are taken) every sixth day for not less than ten weeks.

It will be a welcome day in the annals of public health when the epidemiologic importance of malaria carriers gets the recognition that carriers in other diseases have received.

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RESULTS OF THE OPERATION OF VACCINATING

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THE purpose of this paper is to bring out the consequences upon vaccination, and, therefore, the reason for its practice, rather than to go into the oft-repeated history of the subject and the technic of the operation. In dealing with so important a subject, and, at the same time, one so completely exhausted from nearly every standpoint, it will be but fair to recall what untoward, as well as good, results have come to our observation in the train of those vaccinated.

To consider the question of methods of "vaccinating," as we term it, with different forms of virus for diseases other than variola, would be a very large subject to handle in this day of preventive medicine. With enteric fever, tetanus, hydrophobia, yellow fever and bubonic plague, in the broad sense of prevention, whether with a virus (as in the case of hydrophobia), or a serum, problems of susceptibility, anaphylaxis, and infection confront us in addition to the beneficial protective results. With the true vaccination against variola have come sounding through over a century thunderbolts of ignorance, prejudice, and criticism that would threaten the very pillars of a palace of humanity! And why is there so much of this turmoil, if it is not because we do not look the subject square in the face? It must be admitted there have been observed a few very bad complications and sequelæ following vaccination, just as there have been a great many bad mistakes in administering drugs, in severing blood-vessels and nerves, in the unfortunate use of fire-arms, while the very best intentions prompted these acts. But does this mean that curative drugs shall not be administered when they can, that operation for the relief of pain and saving of thousands of lives shall not be performed, that life and liberty shall not be protected to ourselves and dear ones?

As Keisle says, also, in defending the necessary but humane use of the lower animals in carrying out work connected with the prevention

of hydrophobia, "It were better to sacrifice the whole breed of dogs in order to save one human life!" There may be those who would question even the expenditure of money and proper use of the lower animals in obtaining results consequent upon discovering a protective virus.

You may say it is questionable how much good has resulted in vaccinating, despite the sacrifice of lower and higher life, and despite other evil consequences; that communities have been shown free from smallpox, even during an epidemic, without vaccination, whether through chance or what not. Let me say here, also, that it is possible for some people to imagine many other things. Not long ago a colored minister, with a definite chronic skin affection of his scalp, said he firmly believed his trouble was due to vaccination performed years ago; and yet he asked whether this could be so.

Not to attempt to make a defence for vaccination, for its history is its justification, just see what overwhelming evidence there is in good done since its introduction. The time is ripe for another review of this vital problem. A mortality from variola of about 25 per cent. has been reduced to about .6 per cent. under conditions of good vaccination. While, occasionally, there will be a failure, ninety-nine out of every hundred recently successfully vaccinated against smallpox will be protected. Sometimes, even life-long protection will be obtained, and this generally occurs after two successful vaccinations in the same person.

Before the days of Edward Jenner's "Inquiry," 1798, when he stated, "Cow-pox protects the human constitution from the infection of smallpox," this loathsome disease would attack as many as 95 per cent. of the population of a district visited by its ravages. Nearly every one had to suffer from the disease. Those whom it did not carry off with death, it left a hideous spectacle for the home to behold. Before the introduction of vaccination in England, one-third of the population bore scars of the disease smallpox and many were left blind. In those times, over 1800 a year died in London alone (according to Sandwith). This would mean about 5000 a year to-day in Philadelphia. These are some of the results of smallpox: In ten years' time, after adopting vaccination, 20,000,000 were vaccinated; and, in 1912, it was stated there had not been a death in London from smallpox for three years.

Before the year 1874, smallpox was always in Germany. Since then, when compulsory vaccination was enacted, it has wonderfully decreased, until it is now unknown in the Empire. In 1897, only five deaths occurred from smallpox out of a population of 54,000,000. In the Phillipine Islands, where there used to be 6000 deaths a year from smallpox, in 1906 there was not a death. This followed upon the wholesale vaccination of that year. It is strange that in Japan the disease is said not to have been controlled by vaccinating, whether from the virus used, or method of vaccinating, or something not yet accounted for. This statement of its failure is now said to have been corrected. If, also, in a certain district, an outbreak of smallpox can be controlled by isolation and fumigation alone, by all means continue to practise these measures, as they should, at any rate, be practised; but with the eyes of history wide open before us, it seems risky to leave undone the safeguard of vaccinating.

It is the universal experience in city hospitals during an epidemic that the physicians, nurses, and orderlies vaccinated are protected. In 1892 and 1893, at Leicester, forty nurses were vaccinated and six refused; five of the latter took the disease and one of these died. The other one not vaccinated was the matron, who did not come in contact with the disease. In 1898, in Cuba, 4000 United States volunteers were vaccinated and not one took the disease in six months. Over one hundred employes in our own Municipal Hospital during the last epidemic were vaccinated and protected. (Epidemics now instead of being every seven or eight years are not oftener than every ten or fifteen years or not at all.) Two unvaccinated at the hospital took the disease; one of these died and the other was left horribly scarred. Of the many medical students who visit the hospital to study smallpox only one contracted the disease, and he was discovered not to have been vaccinated but opposed to it. Dr. W. M. Welsh, in handling five thousand cases of smallpox, states that not a nurse became infected in coming in contact with smallpox if vaccinated before coming on duty. In 1912, over 2000 vaccinations were performed by the Philadelphia public school physicians.

President Jefferson was extremely ardent in endorsing the introduction of vaccination into this country, and particularly in the Southern States. He wrote a letter to Jenner, in 1806, saying: "You have erased from the calendar of human affliction one of its greatest,"

and he predicted a time when smallpox would no longer exist, as a result of Jenner's ingenuity. These, as expressed in the English investigation, are some of the good results of vaccination—mortality is reduced, attacks are lighter, fewer children take the disease, revaccination protects for good. As a further result, every civilized nation has officially sanctioned vaccination.

Now, to be perfectly fair, for results include good and bad alike, we must admit that the history of vaccination contains a few calamities, just as in the marvellous successes in the administration of von Behring's diphtheria antitoxin, and just as in the unforeseen accident that might happen to one out for a stroll with the good intention of seeking invigoration. Bad results from vaccination, however, are preventable and should be prevented!

It is part of the duty of the United States Public Health Service to see that harmful virus is excluded from the market. It is the duty of every physician to see that an aseptic operation is performed, and cleanliness is enjoined and observed afterwards. When the State offers to vaccinate all, as she should, she should also medically and thoroughly attend that case as a child in the hands of its care-takers, and be responsible for warding off accidents. Then all reasonable precautions have been taken. It is like a great railroad system: not only rail inspection, block systems, and danger signals are employed, but caution signals and other additional means are made use of so as to increase as far as possible the assurance given the traveller. Even then, sometimes, danger is not mastered. It is the duty of the family to carry out the advice given, and the surgical cleanliness necessary in the treatment of any wound. Where do we believe most accidents occur in vaccination wounds? At the unclean hands and homes of the very ones who would refuse the best medical instruction on the subject, and then fight against its protection for others!

"Antivaccinationists" have brought out several well-known unfortunate cases for the support of their cause. One is the so-called "Rivalta case," in which syphilis is said to have been communicated to a whole community in Piedmont. This was in the days of the use of human virus. Another is the case of the death of a baronet said to have been due to vaccination. Every year a few deaths attributed to vaccination are brought forth.

As regards the lymph, German government lymph shows success-

ful vaccination in 99.3 per cent. in a series of 446,492 cases. Recent investigations in the United States show the lymph used not to be a carrier of other diseases; some hundred thousand specimens failed to show the presence of the tetanus bacillus. The great precautions observed in the preparation of the virus bear out these investigations.

"Blockley" has been vaccinated and revaccinated a number of times; and, in case of an epidemic in the city, all visitors to the institution are vaccinated, with the result that the place has been kept free from smallpox. In 1910, fifteen out of ninety-eight took (about 15 per cent.); while, in 1911, with the use of fresh virus in sterile tubes and the careful use of a sterile needle as scarifier, about 50 per cent. took and the cases were watched afterwards. Many of these individuals had been vaccinated five or more years previously, and some had had successful vaccinations. Seaton says, "A vaccination presenting any deviation from the perfect characteristics of the vesicle . . . is not to be relied upon as protection against smallpox." He had one failure to take in 170 persons vaccinated. Statistics, taking them for what they are worth, show that .06 per cent. take if there are four marks, that the best vaccination is thirty times more useful than the worst, and that the worst is over forty-seven times better than none at all.

Vaccinia itself, when extensive over the body, may be an annoying sickness of some weeks' duration, but it is infinitely to be preferred to smallpox in such an individual. Roseola is a simple macular eruption that sometimes follows vaccination.

Among the diseases that are said to have been communicated to people through vaccine virus are erysipelas, sepsis, and gangrene from uncleanness, syphilis through the use of a human virus, and possibly a latent tuberculosis lit up by a severe reaction.

Cases of tetanus have arisen through uncleanness of the wound. The generally short incubation period of tetanus has shown this to be true. It may be of interest to know that one of such cases, moreover, recently seen at one of the hospitals for treatment, was cured by large doses of tetanus antitoxin. Sometimes erythema multiforme, eczema, impetigo, urticaria, questionably lichen, and also purpura may accompany the vaccination, as they accompany other things. Exuberant granulations and keloids have followed upon vaccinating. In one case there was evidently a notable tendency towards keloid formation,

for a physician afterwards thoughtlessly or carelessly excised the keloid at the seat of vaccination, and there recurred a much more extensive one at the site of excision.

On one occasion, at the City Hospital, the writer admitted a case recently vaccinated; and, in addition, bearing vesicular and pustular lesions about the mouth and digits. The child was quite sick, and was isolated upon admission. Consultation was held, with the suspicion of "foot and mouth disease," possibly following upon vaccination. The suggestion was made to inoculate a calf; this was done and the result was negative. The child died and no further investigations in this case were carried out. We must be on the lookout, however, for cases of this disease, as epidemics sometimes occur in cattle. In 1908, fifty-five head of cattle were killed on a farm not far from West Chester, because of "foot and mouth disease." What we here wish to imply is that these problems have to be looked at square in the face, even by ones who have been brought up to feel the great benefit of vaccinating; and if it be true that, as in one case investigated by the courts, death from meningitis was supposed to have been caused by an infected vaccinated arm rather than by extension backward from a severe panophthalmitis, the horror is not to be evaded but made example of and corrected. The trouble is that families are too liable to jump hastily at sensational conclusions. Where several conditions exist it is often hard to prove a point.

Of course, free vaccination costs the State considerable money; but what is that compared to the cost of ravaging epidemics and wholesale loss of human life? Some few people seem to have a natural immunity, and vaccination of them will not take at all. Whether vaccinia is in reality a mild form of smallpox (as Prof. Welsh is inclined to think), or an entirely different disease, according to Rosenau and others, is still a mooted question, and one not to be gone into here. But we must persist in careful vaccination and revaccination to get good results. The moral I would draw from this display of both beneficial and some untoward results in vaccinating is, that every one should be offered the protection given by vaccination so long, at any rate, as there exists such a disease as smallpox; present to your brethren the responsibility that rests upon the medical profession to attain greater perfection in the practice of vaccinating the population

of a State, and not give the enemies of the cause a chance of presenting even accidental sequelæ as a text for condemning vaccination. Since the Act of 1907, under the "Conscience Clause," more exemptions to vaccination have been granted in England, so that in some provinces less than 10 per cent. of the children have been recently vaccinated. Part of England, at least, lamenting any spread of emotion and ignorance, would welcome fuller vaccination protection of her people. Our careful scrutiny of newcomers, and our immigration regulations, help keep the land as clean as it is. Even with these restrictions, with the difficulty of early differential diagnosis of some of the exanthemata, troubles arise and have to be checked.

The Medical Society of the State of Pennsylvania has already set forth the logical reasons for adding to the protection of our citizens by means of vaccinating. We recognize the importance of early diagnosis, isolation, disinfection and vaccination, and endeavor to practise these properly. In conclusion, let it be said that there need not be a single bad result in properly vaccinating and following personally with medical skill to a close the cases vaccinated, and where compulsion is practised, whether merely for attendance upon public schools, or for every one, as in the case of a number of the nations, the guarding of the vaccinated should be as compulsory as the vaccinating.

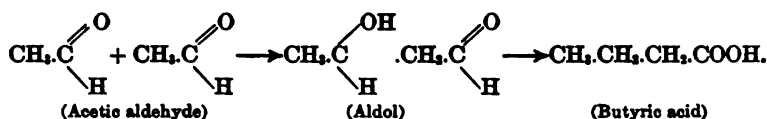
FOODSTUFFS

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THE conception which accounts for vital phenomena in the most intelligible manner regards life and metabolism as inseparable—a continuous stream of interactions amongst the constituent molecules of tissue cells and fluids, foodstuffs, etc.

Protoplasm appears to be an emulsion of proteins and lipoids. The protein portion contains one or more carbohydrate radicals; and carbohydrates are readily converted into fats; *e.g.*, lactic acid produced by fermentation of lactose breaks down into acetic aldehyde and other bodies; two molecules of acetic aldehyde condense to form aldol; reduction of the β carbon group and oxidation of the aldehyde group of aldol produce butyric acid.



Lactic acid is derived from sugar in the same way. In general, it may be stated that the reaction is good for acids of straight unbranched chains, containing even numbers of carbon atoms, by condensation of three or more acetic aldehyde molecules.

The amino-acid alanin, a constituent of most proteins, is readily converted into lactic acid.

Leucin, tyrosin, and phenylalanin give origin to β -oxybutyric acid, which last produces aceto-acetic acid, and this in turn may give origin to acetic aldehyde.

Glycin and alanin are readily converted into glucose. Meat can yield in katabolism 58 per cent. glucose. It has been estimated that in diabetes 45 per cent. of the total sugar may arise from the four amino-acids, glycin, alanin, aspartic, and glutamic acids.

There is experimental evidence to show that degradation products of proteins in the presence of carbohydrates are resynthesized. The

importance of carbohydrates is further seen in the fact that in feeding animals with amino-acids, no retention of N occurs in the absence of carbohydrates. In hunger, the last traces of glycogen disappear but slowly, and sugar is never absent from the blood even at the end of starvation. If carbohydrates be cut off in the food the organism obtains them from protein. When the pancreas is diseased or removed, whereby carbohydrate metabolism is seriously interfered with, N appears in large quantities in the urine. The ingestion of protein is followed by a marked rise of nitrogen in the urine, mostly in the form of urea; and it is now certain that the greater part of this N arises from the protein ingested and not from the tissues. Indeed, in health, the amount of N excreted is proportional to the amount of N taken in the food.

The gastric digestion of proteins into proteoses and peptones is largely preliminary to tryptic and ereptic digestion—formation of amino-acids. It is significant that the liver-cells carry this cleavage further than can the alimentary enzymes, producing, *e.g.*, disintegration of glycyl and leucyl-glycine, both of which are resistant to trypsin.

Soon after absorption proteins are split into (1) a nitrogen-containing and (2) a nitrogen-free portion. As nitrogen is an essential to living tissue, the value of the nitrogen-containing portion is admitted. The question here arises, does the nitrogen-free portion perform a special part in metabolism which cannot be effected by carbohydrates or fats? The answer appears to be in the negative.

It was formerly held that the tissue-cells prefer proteins for all their requirements, and that only when proteins are used do they fall back on non-nitrogenous stores. This view must now be discarded; rather must the body get rid of unnecessary N before the really valuable part of the protein molecule is admitted to the general circulation.

There is much less cohesion amongst the labile proteins in the body than amongst those without it. Tissue-cells can remove ammonia from amino-acids. In amino-acids N and C are united firmly and are not broken by proteolytic enzymes nor boiling acids; but the tissue-cells bring about this separation readily.

The toxic condition produced by protein destruction in fever may be prevented by the administration of carbohydrates. Protein synthesis in plants is impossible in the absence of carbohydrates. Carbo-

hydrates in quantity in a diet reduce the amount of protein katabolized; *i.e.*, carbohydrates are spacers of protein.

Fats and oils are used in animals and plants as sources of reserve energy. During starvation as much as 90 per cent. of the energy liberated in the body may be derived from fat; whilst a large portion of the fat found in animals has been synthesized by plants, there is evidence to show that the synthesis of higher fatty acids can be effected by animals. The reduction of the β -alcoholic hydroxyl group, accompanied by the oxidation of the terminal aldehyde group, as noted above, appears to be a more or less general reaction. In order that fat stored in the body may be used for oxidation, it must be desaturated; *i.e.*, its iodine value must be raised. For this purpose it is transported to the liver, the organ in which the bulk of the desaturation appears to take place. The liver, like the heart, contains fats rich in phosphorus—phospholipines. These, when saponified, yield about 60 per cent. fatty acids, whereas connective-tissue fat contains about 95 per cent. fatty acids. When there is excessive mobilization of fat the liver contains fats of low iodine value. Certain enzymes in the liver weaken positions in the chains of carbon atoms, forming fatty acids, and, in this condition, these are handed on to other organs where they are finally broken down. Thus acids formed by successive oxidation at the β -carbon atom break down to still smaller molecules, such as CH_3COOH , which are finally burnt to CO_2 and H_2O .

These considerations show that the views held a few decades ago concerning the so-called all-importance of proteins in the body, and the unimportant rôles played by the dead carbohydrates and fats must be now cast aside, and that in the vital processes of metabolism fats and carbohydrates must take their places on the same plane with proteins. Moreover since their katabolism results in their complete transformation into the harmless forms of CO_2 and H_2O , whereas the oxidation of N is with difficulty carried through highly-toxic stages, the larger use of the non-nitrogenous, and the smaller use of the nitrogenous constituents of food, seems to be a necessity to health. In modern conditions of civilization, in which oxidation is reduced below the normal, this necessity is all the more imperative.

The amino-acids of vegetables appear to be the same as those of animal tissues. Recent work in nutrition supports the view that the quality of the proteins ingested is of the first moment, and that quan-

tity cannot serve as a substitute; moreover most careful workers are now inclined to agree with the conclusions of Chittenden; viz., that the protein requirements of the body are not so large as previously thought.

The class of bodies referred to above, as lipolines or lipoids, to which lecithin belongs, appears to be present in at least small quantities in most foods.

The palatability of foods is a quality of more importance perhaps than has been generally acceded to it. Palatability is a necessary preliminary to a full secretion of digestive juices and to complete digestion; and apart from complete digestion normal metabolism cannot be effected.

In connection with the treatment of the so-called residual diseases the elimination of all but the necessary nitrogen appears to be the method of the future.* Racemic amino-acids, for example, are only burnt in their natural parts; the other part is excreted unchanged.

* See page 55.

TRAUMATIC PNEUMONIA

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AND

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FOR a good many years the influence of trauma as a factor in the etiology of pneumonia has been very generally recognized by authorities on that disease, though some have hesitated to admit such a connection. That much has been written on the subject is evident to any one who looks at the list of references in the Second Series of the Index-Catalogue of the Library of the Surgeon-General of the United States Army. The entries under the heading "Pneumonia (Traumatic)" occupy more than a page, and this is in addition to what is given under the heading "Pneumonia (Postoperative)." Of cases of pneumonia, however, only a very small proportion can be attributed to trauma, and accordingly a brief reference to this mode of causation is sufficient for systematic treatises, unless these are of a special or very elaborate kind.

One is so familiar with a history of injury antecedent to local infective processes, such as tuberculosis of bones and joints or syphilitic lesions in or about the cranium, that it is perfectly reasonable to suppose that trauma may prepare the way for pneumonia by lowering the resisting power of the lung tissue. Litten¹ drew a sharp distinction between "traumatic pneumonia," in which there is direct injury to the lung, and "contusion pneumonia," in which no trace of injury is visible on the chest wall, even though a post-mortem examination may subsequently reveal lacerations of the heart and lungs. Moreover, he pointed out that the contusion pneumonia does not necessarily develop at the part corresponding to the seat of application of violence. Litten went further and said that there need not be direct force applied to the thorax: the strain of lifting heavy weights might cause pneumonia. If we are prepared to go this length

¹ *Berl. klin. Woch.*, 25th Feb., 1907, S. 229; *Deut. med. Woch.*, 28th Mar., 1907, Nr. 13, SS. 499-502.

with Litten, it is a simple development of the principle to assume that injury to any part of the body may give rise to pneumonia through the agency of general shock or general lowering of resisting power; just as pneumonia and pleurisy, as every one knows, are often due to a severe general exposure. Different authorities will, of course, apply tests of different degrees of stringency in deciding whether, in a given case, pneumonia which has followed an injury to the chest, or some other part of the body, is to be regarded as having been caused by that injury. In some cases the relation of the pulmonary disease to the injury, with respect to localization and time of onset, is so striking as to convince any reasonable observer,² but in other cases there is room for difference of opinion as to the correct interpretation of the facts.

We have recently examined the records of cases of pneumonia which had been treated in our service of wards in the Glasgow Royal Infirmary during the period from October, 1899, till December 31, 1912, and in addition one of us examined the records of the last 100 consecutive cases seen in private in the period ending at the same date. One of the first and most conspicuous results of this inquiry was to show the fallacious character of any statistics of contusion pneumonia which are not based on an enormous number of cases. We are not surprised that writers who base their figures merely on cases which have come under their own observation differ widely from one another in their estimates of the relative frequency of injury as a cause of pneumonia.

Czyhlarz³ quotes estimates from different writers, showing such extremes as 4.4 per cent. given by Litten, and 0.1 per cent. given by Jürgensen and approved by Aufrecht; whilst between these are Stern with 2.8, Demuth with 1.6, and A. Fränkel with 0.8 per cent.

Musser and Norris⁴ give 0.85 per cent. as the proportion of traumatic cases among 6790 cases of pneumonia collected by themselves; but they also quote such widely differing estimates as those of Moelmann, 1 in 944 (0.106 per cent.), and of Baeck, 5 in 340 (1.47 per cent.).

² There could scarcely be a more convincing illustration than is furnished by a case recorded by J. W. Mathie in the *Glasgow Medical Journal* for Sept., 1912, pp. 169, 170.

³ *Wien. med. Woch.*, 8th July, 1911, No. 28, 1797-1801 (with literature).

⁴ Osler and McCrae's "System of Medicine," vol. ii (1907).

The *Collective Investigation Record*⁵ includes only three cases out of 1065 as "associated with injury." One was "caused by injury to chest wall." Another "arose eleven days after amputation of the breast." The third began "while the patient was in bed with broken leg." All three recovered.

In the hundred consecutive private cases diagnosed as pneumonia (excluding certain doubtful cases, such as pleuropneumonia, pneumonia with ear disease, and septic pneumonia after tonsillotomy) there is none which has a self-evident claim to be regarded as traumatic, though there are four which deserve further mention. A puerperal case setting in on the third day after labor was probably septic, though great precautions had been taken by the medical man in charge. The three others were postoperative. One patient was an elderly man in whom pneumonia developed some weeks after an operation for stone. In the case of a lady of thirty-five the symptoms began about the second or third day after ovariectomy, but the attack as a whole was a slight affair. In a lady of forty-six the disease followed removal of the tube and ovary on one side, and of a dermoid on the other. It was probably an aspiration-pneumonia resulting from the ether anæsthesia. There is accordingly no clear evidence that any one of these hundred cases should be entitled traumatic.

Of the 582 cases of pneumonia admitted to our wards in the Royal Infirmary in the period from October, 1899, to December, 1912, 139 were females or males under the age of six. Every care was taken in the case of children to exclude cases of bronchopneumonia. From the total number of cases of pneumonia seventeen were collected which were associated with a history of trauma. Five of these were included in the last hundred consecutive male cases. It is soon apparent that in making any calculation as to the relative frequency of trauma as a causal factor in the production of pneumonia the question *post hoc ergo propter* arises; and also—to judge from the comparison of the last hundred male cases with the whole remainder—that any calculation of this kind must be based on a very large number of cases.

Of the seventeen cases collected, twelve may be fairly taken into account in calculating the relative frequency of traumatic pneumonia. The other five are given as being possibly, but not certainly, examples

⁵ Vol. II, July, 1884, p. 59.

of the condition. An instance of traumatic pleurisy is also given, as being interesting in the consideration of the subject.

The nature of the trauma is varied, and includes direct violence to the chest wall itself, violence to some other part of the body, operation, and parturition; while among the doubtful cases nervous shock, apart from actual discoverable trauma, may have played some part in the production of the pneumonia.

The cases are grouped broadly into the two recognized classes, namely, (1) where the trauma has been applied to the region of the chest in which the pneumonia has subsequently developed, and (2) where the site of the trauma has been at a more or less distant part of the body. To these a third group might be added (though we recognize it here only in connection with the doubtful cases) where nervous shock rather than trauma may have had some influence on the production of the pneumonia. If this third group be allowed, the question arises whether some of the cases in the second group,—*e.g.*, puerperal pneumonias,—should not be included in it.

It will be observed that the cases included under group (1) are all remarkable for the short incubation period: in most a very few hours, and in all less than 24 hours. In Case IV, the time of onset is uncertain, but it is probable that the patient's condition would not allow of accurate examination on admission, so that we are justified in taking the onset of the pneumonia as nearly coinciding with that of the delirium on the day of admission.

In the second group the incubation period varies from three to seven days, from which it would appear that the trauma, though lowering the resistance and thus allowing of the development of the pneumonia, does not determine its immediate presence in the lung; whereas in the first group there is more or less direct injury to the lung itself which permits the pneumococcus to multiply forthwith at the seat of trauma. At the same time it will be noted that in Cases II and IV of group (1) the pneumonia developed in the left lung, whereas it was the right side of the chest which was injured, and, although in Case IV there was also some involvement of the right lung, the pneumonia was first discovered, and was most extensive, in the left. Further, in Case VI it would appear that the pneumonia did not develop in the immediate neighborhood of the injured part.

In group (2) the first three cases give a history of trauma, more

or less severe, involving some other part of the body than the thorax. Case IV is one of postoperative pneumonia, occurring six days after operation. In this case some of the consolidation may have been due to hypostatic pneumonia.

Cases V and VI are examples of lobar pneumonia occurring on the fourth and eighth days of the puerperium respectively.

GROUP (1)

CASE I.—William L., aet. 24; laborer. Admitted to Ward 11 of the Glasgow Royal Infirmary on April 5, 1911.

Three days previously he had been struck on the right side of the chest by an iron bar weighing 5 cwt. He "took a fit of shivering" the same night and felt sick, but did not vomit then, though he did so on the following morning. Pain attacked the right side of the chest and was made worse by coughing. The expectoration was tough and rusty. Pneumonia of the right lower lobe was diagnosed. The patient died on April 10th. There is no record of any autopsy.

CASE II.—James W., aet. 53; hammerman. Admitted to Ward 11 on May 13, 1906.

On the day previous to his admission he injured his *right* side by falling against an iron bar. Cough developed next morning. On admission there was moderate dullness over the *left* base and slight pleural friction. Crepitus "like bone crepitus" was noted on the right side. The temperature had fallen to normal by May 8th. He was dismissed "well" on June 5th.

CASE III.—William M., aet. 62; carter. Admitted to Ward 11 on April 17, 1902.

On April 14th he was struck on the left side by a large case. He had a rigor the same day and developed a cough the same night. On admission there was slight dullness with absence of rigor mortis at the apex and base of the left lung, with a clear interval between. Friction-sound was heard in the left axilla. On April 24th moist rales suggestive of pneumonia consolidation were noted, in addition to the dullness. The patient died on May 3rd.

Postmortem.—Right lung emphysematous and congested. Left lung: upper lobe in a state of resolution, with several patches passing on to abscess; hemorrhage in the pleura over the upper lobe; lower lobe highly congested.

CASE IV.—Joshua B., aet. 74. Admitted to Ward 11 on October 22, 1911.

On the evening of the day previous to admission, while rising from a chair, he slipped and struck his right side against a stone sink. He fell and remained unconscious for five minutes. A little later he coughed up "black, thick blood." After admission he became delirious. Pulse 106; respiration 42. Two days after admission, dullness and tubular rigor mortis were noted at the *left* base. He died on October 26th.

Postmortem.—Subcutaneous emphysema on the right side of the chest, with fracture of all the ribs from the fourth to the ninth inclusive, the sixth and seventh penetrating the pleura. The right lung showed old adhesions posteriorly, and bruising at the seat of fractures. There were scattered patches of pneumonic consolidation in the posterior half of the lower lobe. The left lung showed slight fibrinous exudation on the surface of the upper part posteriorly. The

upper lobe, with the exception of the anterior part, showed a somewhat patchy pneumonic consolidation. The lower lobe was œdematous and congested.

CASE V.—James F., æt. 51; marble polisher. Admitted to Ward 11 on September 11, 1912.

Five days previous to admission he received a blow on the left side of the breast from the handle of a machine at which he was working. He went to his work next morning at 6 A.M., but returned home at 8.30 A.M. on account of weakness. He had a rigor, and suffered from severe cough, with clear, frothy spit, all that day. On the following day the spit became rusty, and from then onward he was confined to bed. He had had a cough with "common glutty spit" for about three weeks previously, and had noted that he was "losing flesh" for the same period. The latter fact he attributed to extra heavy work. Seven or eight years previously he had been an inmate of a consumptive sanatorium for fifteen weeks. He had got rid of his spit at that time in eight weeks, and had had no tendency to cough since. On admission there were signs of pleurisy, rather than of pneumonia, over the lower lobe of the left lung. Temperature, 101.6°; pulse, 112; respiration, 38. On September 18th the dulness was clearing up, and no friction-sounds were heard. On September 19th the dulness had disappeared. The leucocytes numbered 3000 per cubic millimetre (polymorphonuclears 98 per cent.). The patient died on September 21st.

Postmortem.—Healed tuberculosis in apex of left lung, with more recent tuberculosis in lower lobe. Numerous abscesses, apparently tuberculous, but containing abundant pneumococci, throughout both lungs, but especially the left. The left lung had the appearance of a recently resolved pneumonia. (Post-mortem report in Pathological Institute: "Left lower lobe shows intense œdema with some consolidation.")

CASE VI.—James D., æt. 11; schoolboy. Admitted to Ward 11 on May 9, 1912.

On May 4th he got his back hurt by being pushed into an ash bin. He returned home and immediately went to bed. He suffered from great pain in the back during that night, and next morning he vomited bile-stained material and became feverish. There was no rigor. Cough with blood-stained sputum commenced on May 7th, and on May 8th pneumonia was diagnosed by his doctor. There had been pain in the left side since May 6th, at a different place from where the back was hurt. On admission, pneumonia of the left lower lobe was recognized. The temperature was normal by May 10th, and he was dismissed well on May 22nd.

GROUP (2)

CASE I.—Edward S., æt. 8; schoolboy. Admitted to Ward 11 on November 29, 1909.

On November 24th he was kicked on the head. He suffered from headache all night, and was sick and vomited during the next two days, but improved on the fourth day. On November 28th there was a return of the headache and vomiting, and he was admitted to a surgical ward, from which he was transferred to Ward 11 on the sixth day after the injury. He was suffering from pneumonia of the upper lobe of the left lung. On November 30th, the pulse and temperature were normal, and he was dismissed well on January 4, 1910.

CASE II.—James C., æt. 50; laborer. Admitted to Ward 11 on February 15, 1905.

On February 4th he received a crush of the lower part of the abdomen between a heavy cylinder and a heap of pig iron. He was taken home in a cab, and was thereafter confined to bed. There was no external sign of bruising, but both hips were painful. Pain in the right side and headache set in on February 11th, and cough commenced next day, accompanied by scanty, sticky, reddish expectoration. On admission, and while he was in Ward 11, his temperature was normal. The diagnosis of lobar pneumonia of the right lower lobe was made, and word was afterwards received from his doctor that the patient had had a typical pneumonia which was just clearing up on admission. He was dismissed well on March 13th.

CASE III.—Nicholas C., aet. 18; rubber worker. Admitted to Ward 11 on July 3, 1912.

Five days previous to admission he had a tooth extracted. He went to work next morning, but had to return home very soon, owing to dizziness and sickness. His face was swollen, and he remained in bed until admission. There was no rigor. Pain in the left breast set in on July 2nd and was accompanied by a cough with glutty spit. On admission he appeared very ill and had typical pneumonic sputum. There was limited dulness above and outside the left nipple. On the day after admission there was dulness with fine crepitations at the right base. The crisis occurred on July 6th, and he was dismissed well on July 16th.

CASE IV.—Mrs. S., aet. 32. Admitted to Ward 10 from Surgical Ward on January 19, 1909.

She was operated on for perforated gastric ulcer on December 24, 1908. She progressed favorably until December 30th, when her temperature rose to 103° and she complained of pain in the left side of the chest. Dulness was discovered over the left back. Cough developed, and was at first dry, but was afterwards accompanied by dark, purulent expectoration. On January 8, 1909, there were noted dull tympany at the left apex, impairment of percussion-note at both bases, consonant râles at the left base, and coarse, resonant crackles in the left infra-axillary region. The apex-beat was outside the nipple line. On January 19th irregular consolidation was noted at the base of the left lung. The temperature settled gradually and was normal on January 27th, with occasional rises. She was allowed up about the middle of February and was dismissed on March 3rd. She reported herself on June 14th, and the chest was then found to be healthy.

CASE V.—Mrs. Q., aet. 41. Admitted to Ward 10 on May 4, 1912.

She was delivered of a still-born child on April 27th. Pain in the right side, accompanied by rigor, set in three days later. She had been quite well up till the day of her confinement. Labor lasted for one hour. On admission, the uterus was found to be healthy. In the right lung there was well-marked consolidation of the middle and lower lobes. The temperature became normal on the ninth day, and she was dismissed well on May 21st.

CASE VI.—Mrs. M., aet. 32. Admitted to Ward 10 on February 20, 1908.

She was confined on February 6th, and progressed favorably until February 13th, when she rose and attended to her child. Severe pain set in on the left side the same evening. Cough with blood-stained sputum was present next day. On admission, pneumonia of the base of the left lung was discovered. She was transferred to a surgical ward on March 5th, on account of a mammary abscess, having recovered from the pneumonia.

The remaining five cases of the seventeen collected are admittedly of too doubtful a nature to be included with those already given. The first two might be considered in connection with group (1), while the other three might be looked upon as constituting a third group, where nervous shock or exhaustion played a part in producing the pneumonia. The first of these cases was apparently suffering from phthisis for some time before coming under observation, and any pneumonia present added itself to the more chronic lung affection. The case is of interest in connection with No. 5 in the first group. In the second case, the patient appears to have been incubating the pneumonia prior to the accident, though the latter may have had some part in precipitating the illness and determining the pulmonary attack. In the third case, there was no evident injury, and the pneumonia may have had no connection with the accident on the day before. Here coincidence must be allowed for. In the fourth case, it may be that the epileptic explosion was ignited by the pneumonic condition, as may occur in children, and as would appear to have been the case in the fifth example, rather than that the pneumonia was contributed to by the occurrence of the epileptic seizure.

CASE I.—Mary Ann C., aet. 17; pithead worker. Admitted to Ward 10 on January 5, 1911.

Two months previous to admission she had her left side severely bruised, "but no ribs were broken." The pain in the side had continued since. Otherwise her general condition was good until eight days prior to admission, when she began to suffer from shivering, weakness, dyspnoea, and increase of the pain in the left side of the chest. There was no expectoration. There was consolidation of the left lower lobe. The leucocytes numbered 9000 per centimetre. She was dismissed "well" on February 11th. She reported herself on December 16th of same year, and slight dulness was then noted at the left base. She was readmitted on January 11, 1912, and stated that the breathlessness and cough had never been entirely absent since dismissal. Phthisis was diagnosed.

CASE II.—Thomas B., aet. 19; mason. Admitted to Ward 11 on June 25, 1906.

On June 23rd he strained his side while endeavoring to prevent a stone from falling. He stated that he had been out of sorts for a week previously, and had been two days off work on that account. On admission pneumonia of the apex of the left upper lobe was found. The temperature fell to normal by lysis on July 1st, and he was dismissed well on July 17th.

CASE III.—Frederick S., aet. 35.

On the afternoon of September 20, 1908, he met with a cycle accident, but he "did not hurt himself." On the following afternoon he had a shiver and began to feel unwell. The same evening pain set in about the lower half of the

left chest, and he developed a cough. On admission he was found to have pneumonia of the lower lobe of the left lung, and he died on September 28th.

CASE IV.—Paul P., aet. 29; ice cream vendor. Admitted on February 26, 1900, in the postepileptic state.

He was dismissed on the following day. He had not suffered from an attack of epilepsy for nine years before this. He was readmitted on March 3rd, with pain in the right side, which had existed since the day after his dismissal. Herpes was present on the lower lip, and he was found to be the subject of pneumonia of the upper half of the right lung in front. The temperature was normal again on March 7th, and he was dismissed well on March 30th.

CASE V.—Mrs. D., aet. 37. Admitted to Ward 10 on July 31, 1903.

She had had two epileptic convulsions on the previous day, and was in the postepileptic state on admission. It was stated that she had scarcely ever been sober for two years, though never actually drunk. On admission she was found to have pneumonia of the right lower lobe. She ultimately died of gangrene of the lung, as was confirmed by autopsy.

The following case of hemorrhagic pleural effusion consequent upon trauma to the chest would seem to have had an inflammatory element, and not to be merely a hæmothorax:

William G., aet. 14; message boy. Admitted to Ward 11 on August 30, 1902.

On August 21st he hurt his left side by striking it against a lamp-post. Next night severe pain began suddenly in the left side. There was no rigor. Cough developed on the day of admission. On admission the temperature was 100.4°, the pulse-rate 128, and the respirations 40. Absolute dullness was found over the whole of the left side, back, and front, except at the extreme apex. There was also displacement of the heart, together with other signs of pleural effusion. Twelve ounces of blood-stained fluid were withdrawn by the aspirator, and microscopic examination of this fluid showed red blood-corpuscles, large vacuolated, epithelioid cells, and an abnormal number of leucocytes. The following day, 1½ pints of blood-stained fluid were withdrawn, after which the heart fell back into the normal position. The temperature reached normal by lysis on September 4th. Pleural friction-sound was heard in the front of the left side of the chest on September 11th. The patient was dismissed "well" on September 30th, though dullness was still present. There was no sign at any time of fracture of ribs.

THE USE OF A SERIES OF VACCINES IN THE PROPHYLAXIS AND TREATMENT OF AN EPIDEMIC OF PERTUSSIS

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LAST December pertussis broke out in the main building of the Hebrew Infant Asylum, an institution which houses about three hundred and fifty children, ranging in ages from a few days to six years. It soon became evident that the disease was destined to assume considerable proportions, and that we were on the threshold of an epidemic. Such an occurrence offered an exceptional opportunity to make an extended test of the value of vaccination in pertussis. The study of an epidemic within the confines of an institution has marked advantages over the study of an equal number of cases selected from hospital or private practice. In the first place, it must be evident that the fact that the epidemic originated from a single source, that the cases were, in all probability, due to infection with the same type of microorganism, greatly simplifies the solution of the problems; it disposes of the question of whether a difference in the severity of symptoms is due to a variation in virulence of the invading bacteria. In hospital or private practice, on the other hand, the cases must always have originated from manifold sources. It is also probably of advantage, from the standpoint of comparison, that these institutional children belong to the same stratum of society; that they have for the most part been reared for a considerable period within the same walls, having the same daily routine, including similar food and an equal amount of outdoor life. These are some of the conditions which are insisted upon in considering the course of experimental infection among laboratory animals, but which can rarely be controlled in a study of infection in man. Many of the hospital studies of the treatment of pertussis are, however, open to the severer criticism that, owing to the poorly defined onset of this disease, there is no means of knowing how long the children were ill in their homes.

This fact is, naturally, of great importance in judging the success of treatment. All these objections can likewise be raised in regard to cases treated in the dispensary or in ambulatory practice; in addition, this class of cases is open to the criticism that one must rely solely upon the opinion of ignorant parents in judging the efficacy of the treatment.

Let us first consider pertussis vaccine in its prophylactic use. Here a field of exceptional promise presented itself. Two hundred and forty-four cases were inoculated with four different vaccines. Vaccine No. 1 consisted of a typical strain of the Bordet-Gengou bacillus obtained from Parke, Davis & Co., and two atypical strains. Vaccine No. 2 was the "Bacterin" (Parke, Davis & Co.), which is stated to be composed of a pure culture of the bacillus of pertussis. Vaccine No. 3 was prepared from four typical cultures of the Bordet-Gengou bacillus isolated by Dr. Anna Williams of this laboratory. Vaccine No. 5 may be termed an autogenous vaccine in the sense that it was composed of three typical Bordet-Gengou strains isolated from cases included in this epidemic. Table I shows the results of the vaccinations. It may be summarized in the statement that *twenty-one of the 244 cases developed pertussis in spite of the prophylactic inoculations*. Let us examine this table somewhat closer. It will be seen that vaccine No. 1 shows by far the greatest number of failures. Two injections of the vaccine were given in each instance, one of 100,000,000, the other of 200,000,000 bacteria. Of the ten cases which developed pertussis five showed the first symptoms two to three weeks after the first inoculation, one after twenty-five days, one after six weeks, two after an interval of two months or more. In considering the results of prophylactic inoculations any cases were discarded and not included in the tabulation which developed symptoms of pertussis within two weeks of inoculation.

TABLE I
PROPHYLACTIC VACCINATION (244 CASES)

Vaccine	Number of inoculations	Number treated	Pertussis
1	2	35	10
2	3	10	1
3	3	141	6
5	3	58	3
		<hr/> 244	<hr/> 20

When we turn to vaccine No. 2 we find rather too small a number of cases to allow of a satisfactory estimate of its worth. Inoculations of 100,000,000, 200,000,000 and 400,000,000 were made at three-day intervals. The one case which developed showed symptoms two and one-half weeks after the first inoculation. It should be mentioned, in this connection, that five of the cases of this group developed ring-worm and were therefore sent away from the institution. As a result, the period of exposure to infection by pertussis was shortened in these cases.

The results obtained with vaccine No. 3 are particularly interesting, as they are so much better than those obtained with the other vaccines. The same doses were given as of No. 2, and with the same intervals. In twenty-four of this group of 141 cases very large doses were given by mistake, namely 500,000,000, 1,000,000,000, 2,000,000,000. One of these cases, nevertheless, developed pertussis. This case (Simon) is of especial interest in that it received two prophylactic

TABLE II

DETAILS OF THE TWENTY CASES DEVELOPING PERTUSSIS NOTWITHSTANDING
PROPHYLACTIC VACCINATION

Name	Date vaccinated	Type of vaccine	Date of onset of pertussis	Severity of disease
D. F.	1/12	1	3/5	xxx
A. A.	1/12	1	1/30	xxx
L. W.	1/12	1	1/26	x
B. A.	1/12	1	1/26	x
A. S.*	1/13	1	3/14	xxx
N. K.	1/13	1	1/29	x
M. G.	1/13	1	3/14	x
I. W.	1/8	1	2/2	x
L. R.	1/13	1	1/29	xxx
D. D.	1/13	1	4/1	xx
A. H.	2/20	3	3/10	xx
B. B.	4/17	3	5/6	xxx
Y. G.	4/17	3	5/20	xx
G. H.	3/24	3	5/8	xx
R. T.	4/17	3	5/13	xx
A. S.*	2/23	3	3/14	xxx
J. S.	3/24	3	6/1	xx
H. A.	4/14	5	5/24	x
J. B.	4/14	5	5/5	xx
L. C.	4/14	5	5/12	x

* Received two varieties of vaccine.

lactic doses of No. 1 about the middle of January and three very large doses of vaccine No. 3 towards the end of February, and, notwithstanding this treatment, developed pertussis on the 21st of March; the disease was exceptionally severe, whooping being continued for a period of ten weeks. The other cases developed pertussis three weeks, six weeks, one month, and one about two months following inoculation.

As the result of prophylactic vaccination with these three vaccines it was determined to make one from cultures obtained from cases in our wards. Dr. Anna Williams was kind enough to prepare a vaccine of this nature, as well as to make cultures from the throats of many of the cases. It should be emphasized that the typical Bordet-Gengou organism could be cultivated in only five cases out of the thirty cultures taken. In most instances other hæmophile bacilli, frequently the influenza bacillus, were isolated. It may therefore be maintained with some justice that in our cases the symptoms may not have been incited in all instances by the Bordet-Gengou bacillus, and that this accounts for the failure in the use of vaccine No. 5. It will be noted that of the fifty-eight cases inoculated, four developed pertussis. All these children received 100,000,000, 200,000,000, and 400,000,000 bacteria. Three of the number began to whoop about one month after vaccination, and one three weeks following the initial injection.

One hundred and thirty children did not receive prophylactic inoculations. This group included a ward of twenty-five infants under the age of one year, and another ward of about thirty infants between the ages of twelve and eighteen months. These children must be considered separately, as they were at all times in bed, so that the danger of contact infection, naturally, was far less than in the case of ambulatory children. Moreover, in the one ward comprising thirty infants no case of pertussis developed, so that they were not subjected to infection, and therefore should not be included among those exposed to pertussis. Only one case of pertussis occurred among twenty-five infants under one year of age. The fact that this case did not lead to further infection shows the difficulties in judging of the results of prophylactic treatment. However, the fact that these infants did not come into close contact, since they were at all times in bed, should of itself exclude them from consideration. It were

a palpable error to compare infection in an infants' ward with that occurring in a ward of older children. This distinction should always be borne in mind in considering the degree of infection in institutions for children. If, therefore, we subtract these fifty-five cases—the thirty where no infection occurred, and where, consequently, no exposure existed, and the twenty-five where exposure was greatly limited by absolute confinement to bed—we have eighty children who were not vaccinated. Of these eighty, sixty developed pertussis. It will be remembered that of the 244 vaccinated cases, twenty-one developed pertussis. There were five cases which cannot be included in the group of either the vaccinated or of the unvaccinated, as they began to whoop within a fortnight of vaccination; the case in the infants' ward constitutes a sixth case, which cannot be considered.

It is difficult to determine the degree of exposure of the various children. No doubt it is true that at the very beginning of the epidemic isolation was less complete and exposure to infection accordingly greater. This period, the early days of the epidemic, corresponds to the time preceding our employment of vaccine. However, granting a certain increased exposure of the unvaccinated at this period, we feel that the disparity in the ratio between the infected and the noninfected is so marked among those vaccinated and those unvaccinated—among the former twenty out of 244, or one in twelve, among the latter fifty-nine out of ninety, or almost three out of four—that vaccination must have played a rôle. It should be mentioned, in this connection, that, with the exception of the infants' ward, pertussis occurred in every ward in the building, and that quarantine regulations were enforced in the cases of children with suspicious or actually manifesting symptoms of the disease.

Table III shows the development of the cases both according to wards and according to months. It will be noted that in April the number of cases began to diminish. This time corresponds to the period of vaccination. In brief, vaccination was undertaken as follows: the thirty-five cases were inoculated with vaccine No. 1 about the middle of January, and the ten cases with vaccine No. 2 about the middle of February. At the very end of March and the beginning of April the large group of 135 cases was treated with vaccine No. 3. In other words, prophylactic treatment upon a large scale did not exist until the middle or end of April. This date cor-

responds with the beginning of the cessation of the epidemic. The epidemic may have been waning of its own accord; however, at this time there was no abatement of pertussis throughout the city. We are therefore of the opinion that the vaccine was of value in preventing infection and in limiting this epidemic, but that it cannot be relied upon in each individual case as a prophylactic measure. It would seem probable that there is considerable difference in the potency of various vaccines, and, following the deductions to be drawn from our results, that a polyvalent vaccine of typical Bordet-Gengou bacilli is most efficient.

TABLE III
DISTRIBUTION OF EPIDEMIC ACCORDING TO WARDS AND MONTHS

Ward	Dec.	Jan.	Feb.	March	April	May	June	Total
I .....	..	..	..	..	1	..	..	1
II .....	..	..	..	..	..	..	..	0
III .....	..	2	3	3	2	..	..	10
IV	*1	14	4	3	2	1	..	25
V	1	2	6	3	..	1	..	14
VI .....	..	..	..	1	..	..	..	1
VII .....	..	..	..	..	3	2	..	5
VIII .....	..	..	..	..	..	1	1	2
X	1	2	..	1	..	..	..	4
XI	1	3	1	5	..	..	..	10
XII .....	..	4	2	1	1	..	..	8
XIII .....	..	2	1	2	1	..	..	6
Total	4	29	17	19	10	5	1	86

* Received two varieties of vaccine.

Active Treatment.—Vaccines were used in this epidemic also in the active treatment of pertussis. As in the cases of prophylaxis, four vaccines were employed; however, one of these (No. 2) was not the "Bacterin" mentioned above, but the "combined vaccine" of Parke, Davis & Co., which is composed of the Bordet-Gengou bacillus, influenza bacillus, various hæmophile bacilli, streptococci, etc. Of the eighty-five cases of pertussis constituting the epidemic, sixty-five were treated by means of vaccines, and twenty were not vaccinated. No other treatment was given to either group of cases. About the same number of children was treated with each of the four varieties of vaccine; the cases were not selected, a change in the type of the vaccine being instituted whenever about fifteen children had been vaccinated. In some cases two vaccines were made use of, just as in

the prophylactic treatment. Table IV seems of especial interest in judging of the efficiency of the vaccine treatment. This table, it will be noted, is composed of the twenty severest cases of the epidemic. In compiling this list we had recourse to the charts which showed the number of paroxysms of coughing and attacks of vomiting which each child had by day and by night, and we were guided also by the opinion of the resident physician and of the head nurses. After the twenty cases had been selected in this way, a table was constructed to demonstrate their relationship to vaccination. It will be seen that of the total number only two received no vaccine treatment whatsoever. Five received both prophylactic inoculations and active treatment during the course of the disease; five were inoculated with two varieties of vaccine. This list, which is essentially a list of thera-

TABLE IV

VACCINATION IN RELATION TO THE TWENTY SEVEREST CASES

Case	Vaccine prophylactic	Vaccine curative	Case	Vaccine prophylactic	Vaccine curative
1	0	0	11	0	1
2	0	2	12	1	1
3	0	1 and 2	13	0	5
4	0	1 and 2	14	0	5
5	1	1 and 2	15	0	3
6	0	1 and 2	16	0	3
7	0	1	17	1	3
8	0	2	18	1 and 3	0
9	0	0	19	0	1
10	0	1	20	3	0

peutic failures, contains representatives of all four vaccines, but it will be noted that, as in the case of prophylactic vaccination, vaccine No. 1 makes the poorest showing. It would seem that this table requires little comment. It clearly demonstrates that the use of vaccines in this epidemic did not lessen the severity of the disease. We should add that pertussis in New York City as well as in our institution was characterized this year by its mildness. Indeed, we did not experience any fatality, and but two cases of pneumonia. In an epidemic of this nature it would evidently be less valuable to judge the results of treatment by considering the number of mild cases than by noting those of exceptional severity. This is all the more pertinent in a disease having the irregular symptomatology of pertussis, where

mild cases can be differentiated with difficulty from the common cough of non-specific origin. In the tabulated cases it cannot be contended that treatment was not begun sufficiently early, as the first vaccination was in almost every instance administered during the first week of the disease. This is as early as we can hope to be able to employ vaccines in the course of any disease. Moreover, a glance at Table II (composed of cases which developed pertussis notwithstanding prophylactic inoculation) shows that where these early inoculations failed to ward off the disease its severity was not mitigated; that in numerous instances not only did the vaccine fail to prevent infection, but that it did not shorten or mollify the course of the illness. In no instance, however, did any harmful local or systemic reaction follow the injection of vaccine. In this connection we may add that all attempts to employ the vaccines for diagnostic purposes proved futile, as a cutaneous, intracutaneous, or subcutaneous test.

The complement-fixation test of the serum was carried out upon ten cases, using the Bordet-Gengou bacillus as antigen. These tests were made by Miss Olmstead of this laboratory, whom I wish to thank in this connection. The number of cases is far too few to allow of a statement of the value of this reaction in pertussis. In general, however, the results would seem to show that this reaction is present for some months after the cessation of all symptoms. Its chief interest is in connection with the still-mooted question of the speci-

TABLE V
COMPLEMENT-FIXATION TESTS

Name	Date of onset	Type of vaccine	Date vaccinated	Severity of disease	Fixation test. June
F. G.	2/ 4/14	3	3/10/14	xxx	xxx
G. S.	3/22/14	3	3/10/14	xxx	xxx
E. S.	2/ 4/14	2	2/25/14	xxx	x
D. F.	2/ 5/14	1 and 3	1/12/14 3/20/14	xxx	x
A. V.*	5/15/14	3	2/ 5/14	x	x
G. H.	5/ 8/14	3	3/24/14	xx	xxx
P. B.	4/20/14	5	4/14/14	xx	x
L. F.*	5/15/14	5	4/14/14	x	x
H. B.	2/22/14	3	4/17/14	xxx	xx
C. C.	3/ 9/14	3	3/ 9/14	xxx	xxx

*Pertussis doubtful.

ficity of the Bordet-Gengou bacillus. It is for this reason that the cases are appended in a table (Table V).

Conclusions.—We have reported upon the use of a series of vaccines in an epidemic of pertussis occurring in an institution for young children. Such occasion furnishes exceptional opportunity to observe this disease, which is characterized by an indefinite onset and an irregular course, and is rarely adaptive to hospital study.

What deductions are to be drawn from the observations which we have recorded? It seems clear that none of the four vaccines, including the autogenous strain, was of value in curing or abating the disease in the epidemic which existed in our institution. That this failure was not due to tardy inoculations is emphasized by the circumstance that many of the severest cases received not only early active treatment but also prophylactic vaccination. No other conclusion seems possible from a review of the epidemic of eighty-five cases and a comparison between the severity of the disease among the vaccinated and the unvaccinated. This conclusion is based solely upon our experience in this epidemic, and does not preclude the possibility that a different dosage of vaccine, or treatment with a modified vaccine, may not prove to possess curative properties.

The use of the vaccines in prophylaxis seemed by analogy to offer greater promise, in view of the established fact that other vaccines—for example, the typhoid vaccine—possess prophylactic but no curative power. This seems to some extent, although far less so, to be true of pertussis vaccine. In view of the fact that twenty children developed pertussis in spite of the prophylactic treatment we cannot compare its protective value to that of typhoid vaccine. However, the number of unvaccinated children who developed pertussis so greatly exceeded the number of the vaccinated who developed the disease that we conclude that the vaccine has protective value in a certain percentage of cases, and that it should be employed in institutions and in families to prevent the spread of this infection.

THE NEPHELOMETRIC METHOD

(Photometric Analysis)

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INTRODUCTION

THE object of this paper is to describe a new system of analysis which greatly shortens the time required for many determinations and which does not demand an extensive knowledge of chemical technic. Results obtainable only after days in a laboratory can now be secured in a few minutes. Thus, the method is of value to clinicians who wish to obtain accurate results quickly for use in diagnosis and to those who have a deep interest in the causes of health and disease, but who have little time for research.

Already the development of new and improved technic of many of the older methods has awakened among medical men a widespread interest in chemistry. But it is the duty of the chemist to so shorten and simplify the processes of analysis that it is possible for *many* clinicians to gather data which will throw light on the normal and abnormal conditions of the body for immediate or future use.

The chief basis of quantitative work is at present gravimetric analysis—the filtering, washing, and weighing of precipitates. In all branches of chemistry and in physiologic work, particularly, this is a long and tedious process and often inaccurate, owing to the colloidal nature of the precipitates, and is largely responsible for the time consumed in analyzing.

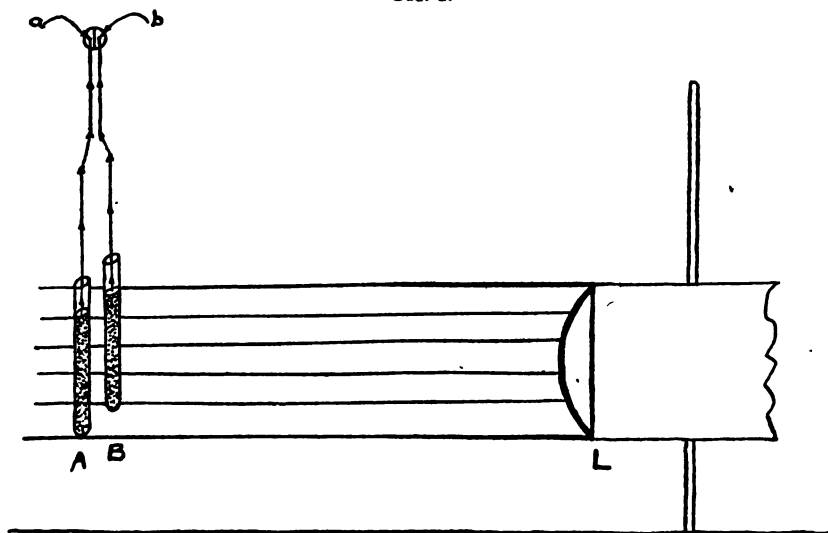
The place of volumetric analysis is already well known, in acidity titration, and in the estimation of chlorides and phosphates in urine, for example. Recently colorimetric analysis has been developed. Colors are produced and are estimated much as in oxyhæmoglobin, by comparison with a known standard. Thus, Folin has reduced to a clinical form the estimation of total nitrogen, urea, ammonia, uric acid, creatine, and creatinine through such colorimetric reactions.

It is now proposed to add a photometric method of analysis called nephelometry. The name is derived from the Greek $\gamma\epsilon\phi\lambda\mu$ meaning a cloud. The basis of the method is the measurement of the brightness of light reflected by a cloud,—in other words, by the particles in suspension,—very much like in an ultramicroscope. The intensity of the light reflected is a function of the quantity of suspended particles when other conditions are constant.

PRINCIPLE OF METHOD

The principle of the nephelometer can best be shown by a diagrammatic sketch.

FIG. 1.



The path of light in nephelometer.

Let *A* and *B* represent tubes containing a precipitate in the form of a suspension, and *L* represent a strong light which throws its uniform beam on tubes *A* and *B* at right angles, then *a* and *b* will be the light in the eye-piece due to the reflections from the two suspensions. If tube *A*, for example, contained distilled water and the instrument were perfect, no light at *a* would be visible. As soon as the smallest amount of suspension is produced in the tube *A*, light is obtained in *a* in approximate proportion to the amount of suspended matter. This light *a* is never measured absolutely, but is always

matched with the light at *b*, which is that reflected by the precipitate of a standard solution—a *known amount of the substance to be determined dissolved in a known volume*.

The matching of the two lights could be done by changing the standard solution step by step until it would be exactly that of the unknown. In practice this would be tedious, and therefore instruments were designed to eliminate this in whole or in part.

INSTRUMENTS

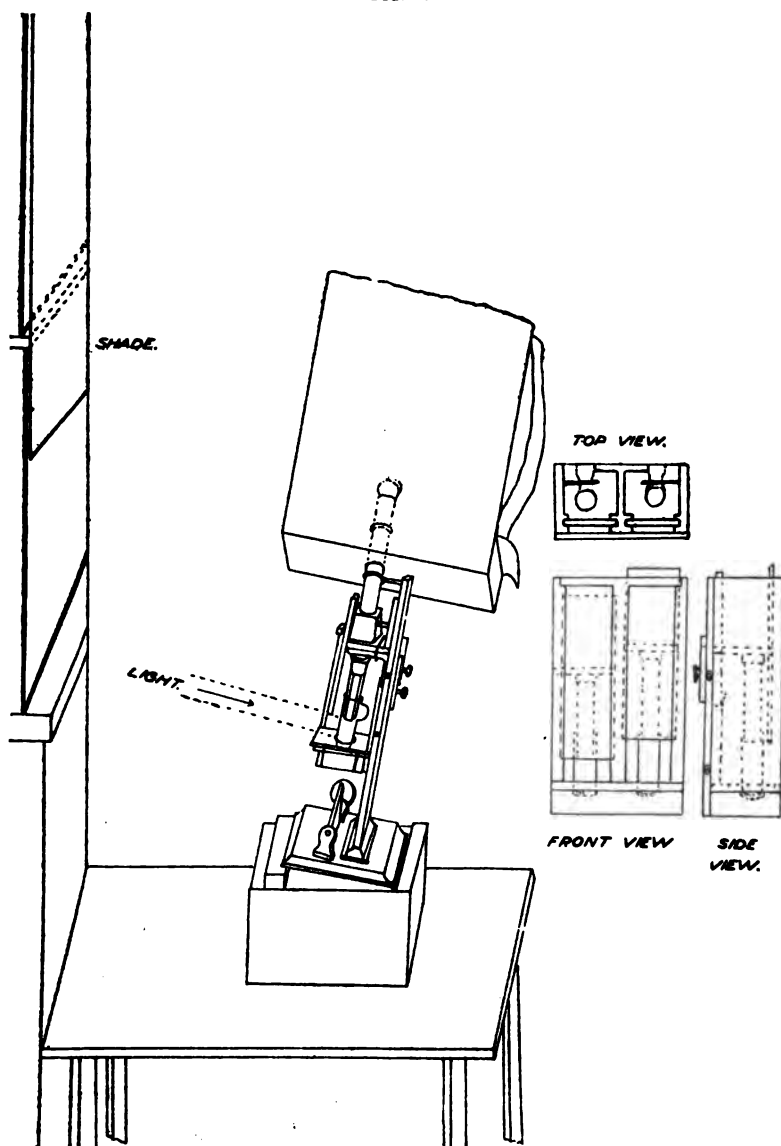
The first nephelometer, designed by Richards in order to obtain a correction for his atomic weight work, was used to estimate the small quantities of substances which he found in his filtrates. Richards expressly states that the instrument is not intended for determining large amounts of substance. The instrument consists of two test-tubes placed near together, slightly inclined toward one another and partly shielded from a bright light by sliding screens. The tubes are observed from above through two thin prisms which bring the images together and produce an appearance resembling a half-shadow polarimeter. Opalescent solutions are placed in the tubes, a solution of known strength on one side serving as a standard. The lengths of liquid layers exposed to the light, indicated by the position of the screens, necessary to produce equality of tint, give a fairly accurate estimate of the relative quantities of precipitate in the two tubes. The positions of the screens are noted on a scale attached to the instrument, from ten to twenty readings being necessary for accurate results.

As the nephelometer described by Richards yields its best results only on taking a large number of readings,¹ and since for practical work so much time for readings is objectionable, an improvement was highly desirable.

A similar instrument of greater accuracy, one that yields reliable results with a few readings comparable to those obtained with a Duboseq colorimeter, would greatly enhance the value of the nephelometer for physiologic chemists. No doubt the Richards instrument sufficed for the purpose for which Richards designed it, and, there-

¹ As stated in a private communication, the Richards instrument rarely departs more than 4 per cent. from the true value on a single reading; the mean of these readings is within 2 per cent.; but to attain accuracy within 0.5 per cent. many readings are needful.

FIG. 2.



First form of the nephelometer.

fore, efforts to improve it were heretofore superfluous. Since, however, the instrument is not desired now to yield a correction to some other analytic process, but to form the basis of the analytic proc-

ess itself and to yield all the figures of the determination, greater accuracy is required.

Without going into the various considerations connected with the construction of the nephelometer, developed in this laboratory, it is sufficient to say that the optical workmanship of the Duboscq colorimeter proved to be an excellent basis on which to build a nephelometer, and the following, therefore, represents an attempt to obtain greater accuracy.

The change from colorimeter to nephelometer, and *vice versa*, can be made in a few minutes with the simple, easily made additions described below. As most laboratories have a Duboscq colorimeter, an additional useful instrument can be produced in this way with little expense.

The essential differences between the new and the older nephelometers are as follows:

1. In the new instrument a plunger changes the height of liquid under observation.

2. A shutter supplements the action of the plunger in cutting off the amount of light.

3. The new nephelometer eliminates three possible sources of error: the meniscus, the indirect reflection of light from suspended matter in the lower part of the tubes, and the reduction of light from one tube to another.

4. The dark shade reduces any error due to the reflection of light on the eye-piece.

5. The new instrument is more adaptable to daylight.

6. Less liquid is needed for a test, 6 Cc. being the maximum amount needed.

7. The instrument is inclined, so as to make observations more convenient and to prevent air bubbles from forming when the plungers are first introduced into the liquid.

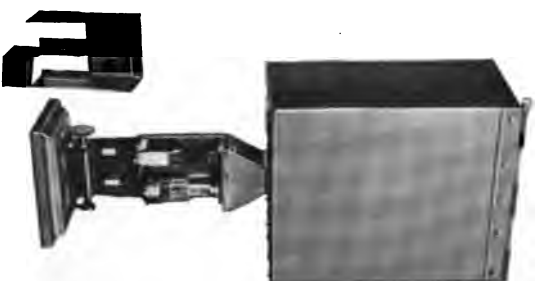
The tubes containing the liquid can be made from soft glass having a bore of 15.2–0.8 mm. by anybody having a little skill in glass blowing.

The nephelometer shown here was made without any special tools or skill from small packing-box boards.

Figs. 3, 4, and 5 show the instrument in the improved form as obtainable on the market to-day—metal being substituted for the wooden parts used originally.

THE NEPHELOMETER.

FIG. 4.



Showing tubes in position.

FIG. 5.



Ready for reading.

FIG. 3.



In portable case.

Fig. 3 shows the instrument in a portable case, which in Figs. 4 and 5 are used as a shade for the eye-piece. In Fig. 4, on the right of the instrument, are shown the regular Duboscq colorimeter attachments, while on the left are shown the new nephelometric arrangements. As may be observed, the only changes² necessary are a coat of black asphaltum paint on the plunger,³ a special nephelometric tube, and a metallic receptacle for the same. Fig. 5 shows the instrument set up and ready for use, with the colorimeter tube on one side and a nephelometer tube on the other.

The shade surrounding the eye-piece is indispensable for accurate nephelometric work, and it has also proved useful in colorimetric estimations. By shutting out the glare of extraneous and conflicting lights and colors it permits the use of both eyes in reading without the usual eye-strain and fatigue. Although in other scientific work similar precautions are used, this seems to be the first application to colorimetric and nephelometric work. In working with optical instruments it is as essential to eliminate errors of vision as to eliminate errors of the instrument.

A small, inexpensive instrument similar to the Hellige colorimeter, suitable for clinical work, is now being developed.

The instrument can be used with daylight, but for accurate work this light is not always sufficiently constant. Reliable results can be obtained with a 100-watt lamp, well screened, placed about one-half metre from the nephelometer. A shielded lamp with condenser, similar to a laryngoscope or "dentoscope," giving a bright beam of light, is most suitable.

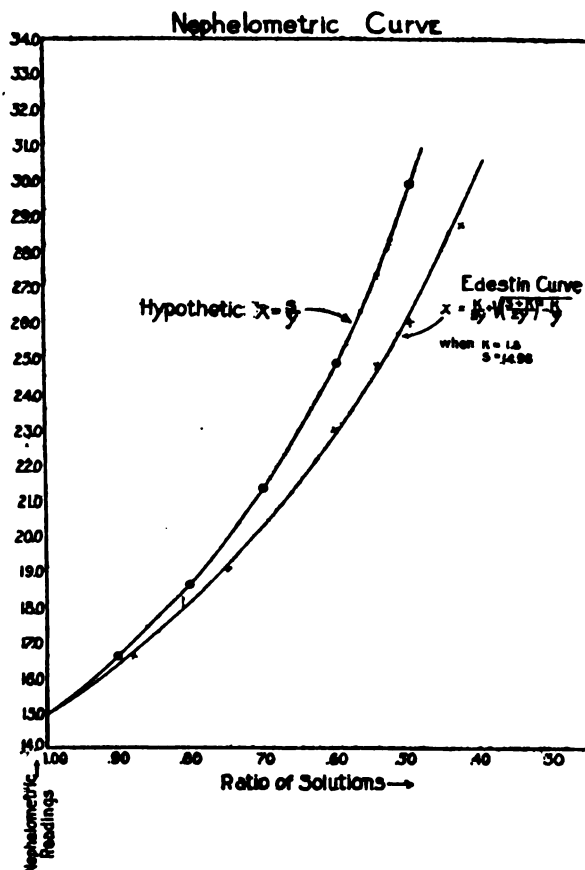
² Eimer & Amend manufacture the necessary additions to the Duboscq colorimeter given above. In ordering one should specify whether the additions are to be fitted to an old type Duboscq colorimeter with movable plungers, or to the new type with stationary plungers. Cost, including four tubes, without combination shade and case, \$13.50, with case \$20, and including Duboscq colorimeter, \$100. The author is indebted to Mr. H. E. Blomquist, of the Mechanical Department of Eimer & Amend, for supervising the construction of the instrument and for many useful suggestions as to practical details.

³ It is best to paint the plungers oneself, and also to have on hand a supply of paint so that the metallic parts can be repainted when necessary. To paint the plungers, it is best to tip them in asphaltum paint and allow them to dry. Then by means of a sharp knife, held at an angle, the circular end may be freed from paint. By painting the plungers in the evening and drying over night they are ready to clean and to use the next morning. Experiments are being made to eliminate the painting of the plunger and receptacles.

THE SIGNIFICANCE OF NEPHELOMETRIC READINGS

To use the instrument for quantitative work, it must be carefully standardized with solutions of known strength, keeping the instrument under the exact lighting arrangements as in actual work. The

FIG. 6.



Curve obtained when nephelometric readings are plotted against ratios of solutions.

amount of light observed in the eye-piece, as pointed out by Richards and by Wells, is not proportional to the weight of the precipitate under observation, but seems to be dependent, to some extent, on the condition of the precipitate, the concentration or amount of substance per cubic centimetre, and the height and thickness of the liquid.

If a standard solution is always used in the same way,—i.e., the same concentration and the same height of the liquid in the nephelometer,—then the readings obtained with “unknown” solutions, plotted against the ratios of the solutions, will follow with considerable accuracy a definite and regular curve, as may be seen in Fig. 6. This curve, as may also be seen, is considerably lower than the “hypothetic” curve where the readings are inversely proportional to the concentration of the solutions. Richards and Wells assumed that when solutions of the same height gave the same amount of light the ratios of the solutions were unity, and that around this ratio the “hypothetic” curve was correct. This is shown to be true by the curves in the chart within 1.5 per cent. when the ratios are within 10 per cent. of unity. It was therefore necessary for Richards and Wells to adjust the volume of their solutions until the ratios were within this limit.

A scheme is therefore presented which practically eliminates this adjustment of volumes.

The curve in Fig. 2 can be expressed in the following equation :

$$Y = \frac{S}{X} - \frac{(1-X)K}{X^2}$$

where Y = height of “unknown” solution, X = ratio of solutions, and S = height of standard solution.

By S is meant the reading of the nephelometer with the standard solution used as an “unknown,” or, in other words, when the ratio of the solutions is unity. This serves to eliminate any errors due to faulty light, tubes, plungers, etc.

Where K = a constant, obtained by substitution of standardization values.

Therefore, if once the value of K is derived for any given standard solution and height of the standard solution, the nephelometric readings will give at once, upon calculation, the ratio of the solutions, and thus no further adjustment⁴ of volumes is necessary.

When the K obtained with one height of standard solution is compared with that of another height, it is found that K is proportional to the height of the standard solution; the equation then becomes, for any heights of liquids within moderate limits,

⁴ Of course, it is assumed that solutions which differ from a standard solution very much, as may easily be observable macroscopically, will require, as in colorimetric work, a more suitable standard.

$$Y = \frac{X}{S} - \frac{(1-X)Sk}{X^2}$$

when $k = \frac{K}{S}$

One has, therefore, the choice of using either one or more standard curves and getting the ratios directly from curves (as in Fig. 2), without calculation or taking any suitable standard, adjusting either or both heights of liquids until the amount of light is matched, and obtaining the ratios by substituting in the nephelometric formula given above. A more convenient form, when expressed in terms of y , is

$$X = \frac{S + Sk + \sqrt{(S + sk)^2 - 4sky}}{2y}$$

When S is kept constant at 14.96, as in the curve, Fig. 2, and when K or Sk has a value of 1.8, the equation becomes

$$X = \frac{16.76 + \sqrt{280.9 - 7.2y}}{2y}$$

DIRECTIONS

For Making Determinations.—To make a determination with the nephelometer developed in this laboratory it is necessary only to precipitate a standard solution with a reagent, put this known solution in both tubes, set the right-hand plunger at an arbitrary point, usually 15 mm., match the two solutions by moving the left-hand plunger up or down, and finally take a reading. Then substitute in the left-hand tube the unknown solution, similarly precipitated, match, and take a reading. These readings, substituted for S and Y in the formula, will give the ratio of the unknown solution to the solution of known strength. For example, a standard solution of edestin set at 15 mm. in the right-hand tube, in the left-hand tube reads 16.6 mm., the unknown substituted in the left-hand tube reads 19.1 mm. Then substituting in the formula, $S = 16.6$, $Y = 19.1$,

$$\begin{aligned} k &= .12, \text{ edestin constant,} \\ X &= \frac{16.6 + (16.6) .12 + \sqrt{(16.6 + 1.99)^2 - 4(19.1) 1.99}}{2(19.1)} \\ &= \frac{18.6 + \sqrt{(18.6)^2 - 152.8}}{38.2} \\ &= .850 \text{ ratio of unknown to standard.} \end{aligned}$$

Since the standard contained .0100 per cent. edestin, the unknown solution contained .850 times .0100 per cent., or .00850 per cent. of edestin. When first using a precipitant it is well to calculate

the value of k by comparing two solutions of a known ratio—for example, 1.0 to .50.

For Precipitating Substances.—Thus far satisfactory results have been obtained by adding the precipitant from a standardized pipette to the standard solution contained in a beaker or small Erlenmeyer flask. The tip of the pipette should be dipped below the surface of the liquid to avoid the entrance of air bubbles. The solution should be gently shaken in a rotary fashion. The nephelometer tubes may be cleaned and dried with alcohol and ether, or in any suitable way, so as to introduce no lint or dirt. It is best to rinse the tubes with a portion of the solution about to be read.

For Reading the Instrument.—The plungers may be rinsed with the liquid to be examined or wiped carefully with a lint-free cloth or lens paper. The metal receptacles for the tubes should also be kept clean, and the overflow of liquid from the tubes should be avoided so far as possible. This can be done by filling the tubes only about three-quarters full. To use the instrument, it is well to insure proper working conditions by putting into the tubes some of the standard liquid and comparing the heights. If readings are consistent though not necessarily equal, one may assume lighting arrangements and other parts are in proper working adjustment.

The following suggestions were helpful in obtaining good results:

1. The instrument was kept in a room where all the lights could be extinguished at pleasure.

2. After the tubes containing the suspensions were in position the room was darkened completely for a few minutes to rest the eyes. Using the instrument directly after coming from a well-lighted room produced less accurate results.

3. Both eyes were kept open in reading the instrument. This was easily accomplished with a shaded eye-piece and produced less strain.

4. It was found advisable not to make the adjustments too rapidly or too constantly in order to avoid inaccuracies due to eye-strain. The final adjustment was made only after relaxing the eyes for a few minutes. The eyes were used alternately: approximate adjustment was made with one eye, and the final always with the other.

5. Readings were made both raising and lowering the plunger in the liquid.

GENERAL CONSIDERATIONS

As has been stated, the nephelometer can be used only when the substance to be determined is in the form of a suspension, which is stable enough to allow readings in the nephelometer before flocculation occurs. The chief requisite for such precipitation is that the substance be in a solution not stronger than 0.01 per cent. Therefore, to apply the method to large amounts of substance it is necessary only to dilute suitably. Clouds produced by 1 part of substance in 500,000 of liquid, as is shown elsewhere, can also be determined.

Since, therefore, the amount of substance seems immaterial, it is important to know whether the nature of the precipitate imposes any limitations on the method.

1. *Color*.—If the precipitate is highly colored and remains in suspension, it is best determined colorimetrically; if slightly colored, it is best determined nephelometrically.

2. *Form of Precipitate*.—It must be colloidal in the form of a suspension. A large number of precipitates found in practical work are colloidal, a number are partly so, while some are so entirely crystalloid, such as barium sulphate, that they settle immediately. In work about to be published from this laboratory certain solutions of protective colloids have been used, such as egg albumin and soluble starch, which cause crystalloids like barium sulphate and other partly colloidal precipitates to remain in suspension long enough for the application of this method.

Thus, the use of the method has been extended to all classes of substances, and, since by careful work considerable accuracy can be obtained, the application promises to be general in the different branches of chemistry.

It must be remembered that the method does not measure the physical properties of a solution like the polariscope and refractometer do, but depends upon the production of a cloud in a clear solution by means of a reagent or upon the increase of a cloud by means of a reagent, and therefore the method is based entirely upon chemical action.

In dilute solutions errors due to contamination or side reactions with other substances are less apt to be introduced than in the stronger solutions used in gravimetric and volumetric work. Certain errors of

the gravimetric method, such as the occlusion of water, mother liquor, or reagent, do not influence the results, because the standard is liable to the same occlusions, thus eliminating the errors. It is, for this reason, of the utmost importance that the standard be precipitated in the same manner as the unknown.

As an illustration of the accuracy of readings obtained with our instrument the following data will suffice. Different solutions were put in an instrument and two observers took readings, which were not compared until the end of the series. The following is but one of many series giving like results:

Readings of Observer A.	Readings of Observer B.
20.6 }	20.6
20.4 }	
25.4 }	25.7
25.7 }	
15.1	15.0
15.2	15.2
15.0	15.0
11.0	{ 11.0
	{ 11.1
16.7	16.7
16.7	16.8
17.0	17.0
16.9	17.1

As is well known, the consistency of the readings of one observer is more important than the agreement of two observers.

That the instrument will detect 1 part of substance in 1,000,000 of water is shown by the following figures obtained with a known casein solution:

Solution used as standard "S."	Mm. of "S."	Solution used as unknown "Y."	Mm. of "Y."
Distilled water	15.0	One volume .0002 per cent. casein and one volume 3 per cent. sulphosalicylic acid ... "A"	1.5
Distilled water	15.0	One volume .0001 per cent. casein and one volume 3 per cent. sulphosalicylic acid ... "B"	3.0
Solution "A"	15.0	One volume .0001 per cent. casein and one volume 3 per cent. sulphosalicylic acid ...	24.0
Solution "A"	15.0	One volume .0001 per cent. casein and one volume 3 per cent. sulphosalicylic acid ...	24.5

APPLICATIONS

The value of the nephelometer has already been demonstrated in work upon milk, blood, urine, and potable water, and also in the estimation of ferment action: in each case the rapidity of the method is very evident.

The determination of proteins (casein, globulin, and albumin) in milk has been accomplished in from twenty to thirty minutes with results comparable to those obtained with the official method, which requires from two to three days. The fat is removed from 5 Cc. of milk by shaking out with ether after the membrane around the globules of fat has been dissolved with a dilute solution of sodium hydroxide. A protein determination is then made by precipitating an aliquot portion of the aqueous solution with sulphosalicylic acid and comparing with a standard casein solution similarly prepared. A similar aliquot portion is then freed from casein by means of acetic acid according to the official method, and the filtrate precipitated with sulphosalicylic acid and compared as was the preceding solution. The difference between the two protein determinations is the amount of casein thrown down by acetic acid, or that obtained in the official method. In the casein-free filtrate the albumin and globulin are determined nephelometrically by means of salt solutions.

Bloor's rapid method for the determination of fat in milk is based upon the light-reflecting power of a watery suspension of milk fat to a similar suspension of standard fat. A colloidal solution is produced by mixing an alcoholic solution of fat with distilled water, and a suspension is obtained by precipitating this colloidal solution with an electrolyte (usually HCl). The method required only a very small amount of milk, ordinarily 1 Cc., and for that reason should be of great value in working with human milk or with the milk of small animals. The time is not greater than that required for the rapid methods now in use. This same principle has been made the basis of a method for the determination of fat in blood.

According to Bloor, the usual method for the determination of fat in blood requires several hours and a considerable volume of blood, usually 25 Cc. "A method was sought which would give satisfactory results in a shorter time and with a much smaller amount of blood—such as might be drawn frequently from a vein without changing the

normal metabolism—a method suitable for physiologic investigation on fat metabolism involving examination of the fat content of blood over a considerable period of time.”

The determination may be completed in three-quarters of an hour with 0.5 to 5 Cc. of blood, usually about 2 Cc. It has been found to be accurate within 5 per cent. of the total fat, the limits of accuracy of the Richards instrument used.

From Marriott we have the determination of acetone in blood. He says in part: By applying the nephelometer to the determination of acetone occurring as such or as diacetic acid, and also that obtained from the oxidation of β -oxybutyric acid, it is possible to make a complete analysis using only 2 to 5 Cc. of blood. The precipitation of acetone is brought about by the addition of a silver-mercury-cyanide solution. The results obtained agree closely with those obtained by iodometric titration, in which iodoform was produced and identified microscopically. This method for the estimation of oxybutyric acid has the advantage over the usual methods, in that very much smaller quantities of β -oxybutyric acid may be determined with accuracy.

Purin bases occurring in the body (xanthin, hypoxanthin, guanin and adenin, and uric acid) can be determined nephelometrically by precipitation with ammoniacal silver nitrate and ammonium chloride; the separation of uric acid from the other purins being made by oxidation of the former with a suspension of manganese dioxide. Phosphates, also, in blood and urine may be determined by using uranium acetate as a precipitant, with a small amount of protective colloid. The results of the work upon the purin bases and phosphates, together with work upon the determination of sulphates, are soon to be published from this laboratory.

Richards's work upon chlorides has made it evident that chlorides in the body fluids can be determined with the nephelometer, but the best conditions have not yet been worked out.

Albumin in the urine may be estimated by precipitation with sulphosalicylic acid, according to Spaeth.⁵ Thus, with the nephelometer the increase or decrease of albumin in urine may be easily followed quantitatively under various conditions of health or diet.

The nephelometer will be particularly useful in the examination

⁵“Untersuchung des Harnes,” p. 397.

of potable water.⁶ Not only will it give the original turbidity, but, upon the addition of suitable reagents, proteins, nucleic acids, and similar substances may be estimated.

In studying ferments a method is desirable which will reveal quickly and accurately any change in the activity of the ferment during the course of an investigation.

A suitable protein for peptic digestion is edestin, owing to its solubility in weak hydrochloric acid solution. Casein is well adapted for tryptic digestion, owing to its solubility in weak alkali solution, and yeast nucleic acid in dilute solutions is similarly suited for the study of nucleases.

In choosing these substrates the following points were considered:

1. For the accurate standardization of these enzymes it is essential not only to have sensitive instruments to measure the rate of digestion, but also to have substrates which are easily digested by these ferments, so that the measurement of activity, like other speed estimations, will occupy as little time as possible. The object in view, of course, is to be able to determine the activity at any time.

2. Casein and edestin may be useful in distinguishing trypsin from erepsin. Fischer and Abderhalden⁷ showed that trypsin digested not only edestin but proteins like casein as well. Dox,⁸ on the other hand, seems to have been the first to prove that erepsin (of certain moulds) was not capable of digesting edestin, while it digested casein with ease. The clinical usefulness of distinguishing between trypsin and erepsin when studying the functional activity of the pancreas or the presence of abnormal enzymes in carcinomatous stomachs is sufficiently obvious.

3. Casein, edestin, and yeast nucleic acid can be obtained fairly pure on the market.

Sodium chloride solution (1 volume of a saturated solution to 3 volumes of water) was used for precipitating edestin, 3 per cent. sulphosalicylic acid solution for casein, and .2 per cent. albumin solution for nucleic acid.

By using the nephelometer one can determine the amount of any

⁶ Preliminary note by P. A. Kober, read at the meeting of the American Chemical Society, Rochester, 1913.

⁷ *Zeitschrift f. physiolog. Chem.*, 60, 81 (1903).

⁸ *Journal of Biolog. Chem.*, 6, 437 (1900).

undigested substance which is precipitated in the form of a suspension by these reagents, and thus follow the digestion of edestin with pepsin, of casein with trypsin and erepsin, and yeast nucleic acid with nucleases, quantitatively.

Sulphosalicylic acid does not precipitate amino acids, peptones, peptides, and urinary constituents under conditions given for nephelometry. Likewise, .2 per cent. albumin, the precipitant for nucleic acid, is not appreciably affected by most substances met with in physiologic work, and will easily detect 1 part of nucleic acid in 1,000,000 of water. The estimation of phosphates and purins referred to previously will give us additional information in the study of nucleases.

The application of the nephelometric method depends mostly on the working out of the precipitants, and it is believed that a large number of reagents are well adapted for this work.

The nephelometer, although at present little known, is not a complicated instrument either as to construction or principle, and will permit an accuracy of from 0.2 to .3 per cent.⁹ While it would be an exaggeration to say that it is applicable to all quantitative work, it is evident that colloidal suspensions are very generally encountered, and, if colorless, must be estimated nephelometrically. This method, which is almost ultramicroscopic, is the only one available for the accurate quantitative determination of small amounts of material which give no delicate color reaction and are too minute to filter, but which are daily demanding our interest and attention. Microchemical analysis is of ever-increasing importance in medicine, as well as in other branches of chemistry, and the nephelometer promises to be a very valuable asset in this work.

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⁹ This accuracy, it is to be hoped, may be increased with the improvement of the instrument.

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THE SYMPTOMATOLOGY AND TREATMENT OF THREE COMMON DISEASES OF THE VERMILION BORDER OF THE LIP

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As our knowledge and experience increase, many cutaneous affections which formerly were considered rare or unusual are found to be of comparatively frequent occurrence. Particularly is this true of disorders which give rise to little or no physical discomfort or deformity, and concerning which medical advice is seldom sought.

Probably the most common disease affecting the mucous surface of the lips is the one first described by Fordyce (*Jour. Cutan. Dis.*, 1896, p. 413), in 1896, and now generally known as "Fordyce's disease."

The following case is a typical example: L. R., male, pharmacist, married, aged 52. Referred by Dr. W. J. Frick, of this city. The patient sought advice concerning a small, pedunculated fibroma which was located on the mucous surface of the mouth, just posterior to the right commissure. In addition to the fibroma, the buccal mucous membrane was the seat of numerous small, closely aggregated, very slightly elevated, whitish-yellow tumors, which varied from a pin-point to a millet seed in size, and gave rise to no subjective symptoms whatever. The majority of the lesions were located on the inner surface of the cheeks, along the interdental line, but the mucous surface of the lower lip, including the vermilion border, also was affected. At various times three pieces of tissue were excised for laboratory study. Two of the specimens were mounted in paraffin, sectioned serially, and stained by the usual methods. The third was cut in a freezing microtome and stained for fat. All of the specimens contained well-developed sebaceous glands. In the first piece of tissue these appendages were confined to the subpapillary region, but in the other two well-defined groups of cells having the morphologic and tinctorial characteristics of sebaceous glandular substance were found scattered through the prickly layer. In some in-

stances indistinctly outlined collections of fat containing cells projected downward into the corium in such a manner as to suggest the development of new glandular systems. The upper cells were flattened and granular, the lower distended, plump, and filled with material which stained deeply with sudan III.

In the second and third specimens especial care was observed in sectioning, and the material cut exactly at right angles with the surface, in order to avoid the possibility of confusing the relative positions of epidermis and glandular substance. Consequently there could be no mistake regarding the presence and location of the sebaceous cells in the epidermis. The glands are probably a late development of preëxisting embryonal elements, as suggested by Audry (*Monats. f. prakt. Dermat.*, 1899, xxix, p. 101). The papillæ were hypertrophied, the lymph-spaces dilated, and the papillary vessels hypertrophied, with some perivascular round-cell infiltration. While the lesions are always benign and do not even predispose to malignancy, their presence occasionally gives rise to discomfort or even pain, and the afflicted individual insists upon their removal. This can be accomplished by excision, or, if the involved areas are not too extensive, by destruction with the electric needle, caustics, or the actual cautery. Sometimes very satisfactory results follow repeated and thorough freezing with Pusey's carbon dioxide snow.

A less frequent, yet comparatively common, disorder of the labial borders is one described by Volkmann (*Virchow's Arch. f. path. Anat.*, 1870, i, p. 142), in 1870, and by him named "cheilitis glandularis apostematosa."

The following case is a characteristic example: J. H., male, bachelor, ranchman, aged 46. Since boyhood the patient had suffered from adenoids and hypertrophied tonsils, with resulting nasal and pharyngeal catarrh. Ever since he could recollect, his lower lip had been thicker and more protuberant than normal, and the margin had frequently been covered with thick, whitish, tenacious mucus.

On examination the patient was found to be a typical "mouth breather," with pinched nostrils, a deformed palatine arch, and dark, congested buccal mucosa. The lower lip was heavy and everted, and scattered along the vermilion border were a number of minute, round or oval, crateriform orifices. When the lip was compressed between

Fig. 1.



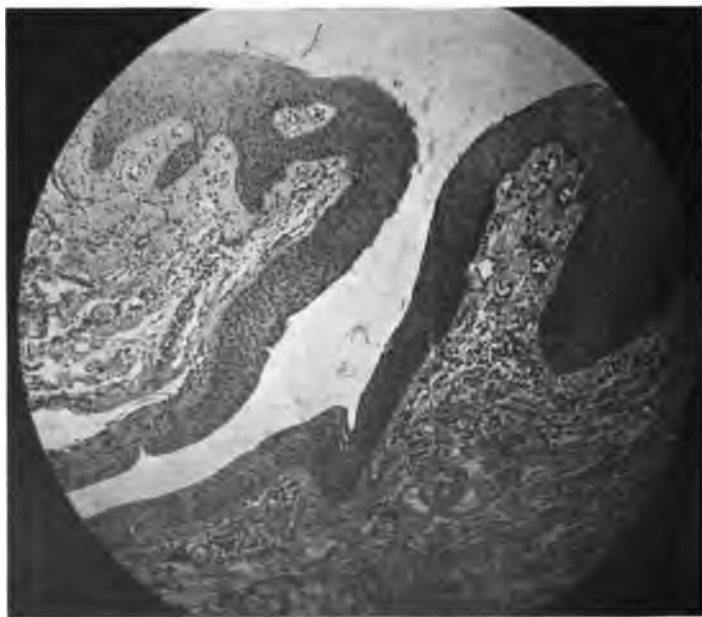
Fordyce's disease, showing sebaceous cells in rite, with perfectly developed glands in derma (moderate magnification).

Fig. 2.



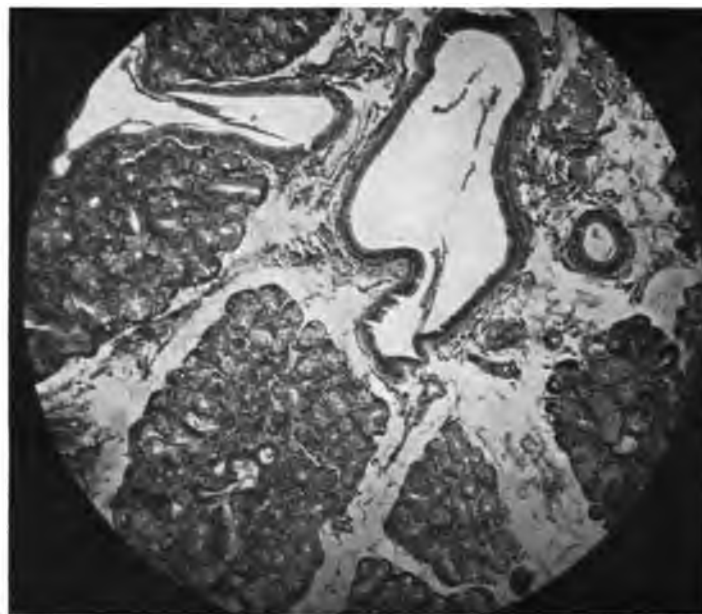
Cheilitis glandularis apostematosa, showing general structure of lesion (low magnification, Spencer 8x oc., 40 mm. obj.).

FIG. 3.



Cheilitis glandularis apostematosa, showing dilatation of main duct and hypertrophy of wall (Spencer 8x oc., 16 mm. obj.).

FIG. 4.



Cheilitis glandularis apostematosa, showing character and distribution of glandular substance (moderate magnification).

the fingers abundant quantities of sticky mucus exuded from the openings, and the walls of the ducts could be felt extending downward, far into the corium. By careful manipulation a slender, blunt-ended probe could be pushed into the larger canals for a distance of 1 Cm. or more, with no resulting pain or hemorrhage.

For microscopic study two of the lesions were removed, under cocaine, by means of a sharp cutaneous punch. The corneous and granular strata were unchanged. The prickle layer was increased in thickness, and oedematous throughout. The rête mucosum was normal. The papillæ in the vicinity of the lesions were hypertrophied. The most striking changes were those affecting the mucous glands and ducts. The canals were enormously dilated, being from six to ten times wider than usual, and the walls were much thickened. The terminal ducts were increased in number and greatly increased in calibre.

There was some glandular hypertrophy, but the changes here were relatively less than in the ducts. The cells were both mucous and serous in character, and in an active state of secretion. There were few signs of inflammation in either the skin or the appendages. The corial vessels were hypertrophied, as might have been expected, but in none of the sections was cellular infiltration or other suggestive dermal change a conspicuous feature.

A considerable measure of improvement can be secured in these cases by the cautious use of the X-ray, but, inasmuch as the condition is a congenital adenomatous one, excision is the best plan. This is most readily accomplished by means of a small Keyes cutaneous punch, the resulting wounds generally healing readily and without incident. A disorder of the lips which was probably described first by Rayer (cited by Crocker, *Dis. of the Skin*, Philadelphia, 1908, i, p. 413), under the title of "pityriasis des levres," and later by Besnier (Besnier-Doyon's translation of Kaposi's *Lehrbuch d. Hautkrankheiten*, Paris, 1891, i, p. 664) as "eczema exfoliant des levres," has become familiar in recent years through the contributions of Stelwagon (*Jour. Cutan. Dis.*, 1900, p. 268; *Ibid.*, 1904, p. 351), who has suggested for it the now generally accepted designation of "cheilitis exfoliativa." The condition is a fairly frequent one in the Middle West.

The following case, recently referred to me by Dr. Harrison B.

Savage, of Galena, Kansas, is a representative one: F. J., school teacher, female, single, aged 19. For several years the patient had been troubled with seborrhœic dermatitis of the scalp and an acne vulgaris which involved the face, back, and chest. The disorder from which relief was sought had been present since puberty, and involved only the vermilion border of the lower lip. The part was usually swollen, and the affected area covered with thin, dry, tightly adherent crusts. Occasionally the corneous flakes peeled off, leaving a smooth, glazed, exceedingly sensitive surface. The exfoliative process could be hastened by the application of cold cream and other unctuous substances, but the scales invariably returned in the course of a few days. Permission to perform a biopsy was refused, but in a previous and equally typical case several bits of tissue were excised for laboratory study. The corneous stratum was thickened, and many of the cells still retained their nuclei, which were slender and spindle-shaped, with the long axes parallel with the surface of the skin. The granular layer persisted, but the individual cells stained poorly and unevenly. There was decided acanthosis, and some minor changes in the rête cells. The papillæ were swollen and the intrapapillary vessels dilated. There was some perivascular infiltration throughout the corium. Considerable numbers of plasma cells were present. No giant cells were found. The elastic tissue was but little affected. The histopathologic picture was that of a chronic inflammatory process of the skin, with resulting hyperkeratosis.

A wholly successful plan of treatment for cheilitis exfoliativa has yet to be devised. An occasional painting with trichloroacetic acid, having first protected the contiguous mucous surface with an absorbent cotton dam, is usually beneficial. The caustic is allowed to remain in contact with the skin for only a few moments, and then thoroughly washed off with water (Davis). Stelwagon has found lactic acid, in gradually increasing strengths, valuable. In my experience, the best results have followed röntgenotherapy, but I must acknowledge that even this method is far from infallible. The condition can be greatly ameliorated by the daily use of a phenol (1 per cent.), salicylic acid (1 per cent.), and rose water ointment combination. The presence of this disorder, particularly in an aggravated form, undoubtedly predisposes to the development of epithelioma, and for this reason the condition should never be neglected.

Fig. 5.



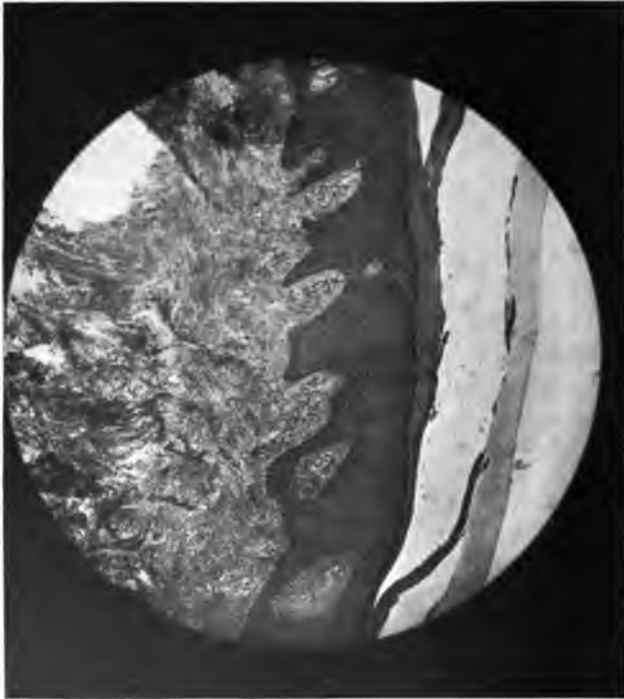
Cheilitis exfoliativa (case described in text).

Fig. 6.



Cheilitis exfoliativa of two years' duration, showing heavy crusting, accompanied by seborrheic dermatitis of face and seborrheic dermatitis of scalp.

FIG. 7.



Cheilitis exfoliativa, showing hyperkeratosis, with exfoliation, acanthosis, papillary hypertrophy, and cellular infiltrate in upper corium (moderate magnification).

Electrotherapeutics

SOME PRACTICAL POINTS ON THE THERAPEUTIC APPLICATION OF STATIC ELECTRICITY

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MANY of the older methods of static application which have been found therapeutically valuable in the past are of course of equal value to-day. Newer methods of static application, while they have in no sense vitiated the old and well-established methods, have added value to the application of static electricity, and have made the use of this agent not only possible but preferable to any other and all other means of treatment in certain cases that were not amenable to treatment by the older methods.

Our knowledge of the physiologic and therapeutic properties of static electricity is largely empirical; and, as we advance along this line of study, it is well that we try to consider, so far as it is possible, the physical and chemical properties of the agents that we are using. It is well, also, that we try to understand the nature of the tissues of the body that we are to treat, together with their physical and chemical properties and their action under the varying degrees of stimulation by static electricity.

Static electricity as supplied by our office machines is, as we know, of very high potential and of low amperage. It is capable of a high degree of concentration and great diffusion; its power of penetration is also very great, so much so that it passes readily through material that will completely insulate currents of low potential. It will pass through glass under favorable conditions, and even dry air will not completely stop its passage.

The human body must be considered as a compound conductor. It is composed of tissues that offer all degrees of resistance, from the dry skin, whose resistance is very high, to the liquids of the body, which are good electrical conductors. Intermediate or between these there exist the solid tissues, varying in degree of resistance according to

their structure. When Graham discovered that the tissues of the body were composed of colloids and crystalloids, a fact was established upon which to work out many experiments in physical chemistry and electro-physiology, and which opened up to us a broad field for electro-therapeutic research.

In the present state of our knowledge we are not prepared to say just what action is produced upon the crystalloids of the body (especially those crystalloids which are classified as electrolytes) by the passage of static electricity through the tissues. Experiment teaches us that the chemic action is very slight except under certain favorable conditions. What the physical or mechanical actions are upon the electrolytes it is not easy to determine; however, it would seem that the body electrolytes act only as a means of easy conduction for the static currents to the more resisting structures that compose muscle, nerve, and glandular tissues, and which, in a large measure, are classified as colloids. Where there is but little resistance to the flow of a current there is, of course, but little work accomplished in the circuit. Hence, we are justified in the belief that nearly if not all physiologic and therapeutic effects that are produced by the action of static electricity are produced by its action upon the large resisting molecules of the colloid tissues.

"In the living animal we have to deal with complex mixtures of crystalloids and colloids, between which there exist relations so varied that they are in part still incapable of investigation. Connected with the uninterrupted vital activity of the cell, the anabolism and catabolism of its substance, is the conversion of crystalloids into colloids and colloids into crystalloids." ¹

The living substance protoplasm, the protoplasm of all cells, is classified as colloidal material, and is highly susceptible to all forms of stimulation, and especially so to stimulation by all qualities of the electric current. It has long ago been discovered that "weak currents stimulate the movements of protoplasmic cells, while strong currents cause the cells to assume a spherical form and to become motionless." ²

In our investigations—physiologic, pathologic, and therapeutic—of the effects produced upon the human body or parts thereof,

¹ "Physical Chemistry in the Science of Medicine," Paulin.

² "Kirke's Handbook of Physiology."

we can in no sense eliminate the protoplasmic cells. Inasmuch as we are unable to subject the living protoplasm to physical and chemical experimentation, we must select some form of proteid substance that will give us some idea of the action of the current upon this material and the reaction of the colloidal substance under such stimulation.

Under the older methods of unipolar application of the static current it was quite difficult, if not impossible, to conduct experiments with any degree of accuracy. However, by the application of the bi-polar methods (such as I have described on several occasions, and which I have used for fifteen years) it becomes easily possible to make quite accurate experiments. We are able carefully to note the polar action of the current when passing through an electrolyte and also while it is passing through colloidal substances. A brief description of the bi-polar current and its application, as well as some experiments made with it, will not be out of place here before taking up the question of therapeutica.

When the sliding rods of a static machine are approximated for any length of time, the machine is apt to lose its charge, even when the machine is in motion. Here the internal resistance and external resistance are unequal, and a loss of charge is the result. The human body (when absolute contact is made by electrodes from the two sides of a static machine) offers so little resistance to the current that the result is practically the same as that resulting from the approximation of the sliding rods. In order to overcome this trouble and to make a bi-polar application of static electricity, we must introduce resistance in the outside circuit between the patient and one or both prime conductors. This may best be done by attaching the patient by conducting cords to ball electrodes and these in turn are brought as near the prime conductors as it is desired, thereby creating extra spark gaps of the length and capacity needed. The longer the extra spark gaps the greater will be the tension of the current. The shorter the extra spark gaps the greater will the amperage be. But, of course, the latter is small under the most favorable conditions, and is always greatest when the revolving plates are in rapid motion. The sliding rods are always fully separated in using the extra spark gaps except when a surging effect is advisable. Then they may be alternately separated and approximated as slowly or as rapidly as the occasion requires.

EXPERIMENT NO. 1

A clear glass tube of half-inch calibre and ten inches long was filled with egg albumen and tightly corked at each end. The corks had copper wire passing through them and penetrating two inches on each side into the albumen, while the outer ends were looped to make contact with the cords from the extra spark gap balls. The distance between the poles inside the tube was six inches. The tube was placed in a horizontal position and as nearly level as possible, the air bubble being at or near the centre of the tube. The cords leading from the balls forming the extra spark gaps were attached to the two loops of wire leading into the inside of the tube. The machine was set in motion, three hundred revolutions per minute, with the extra spark gaps open two inches on each side. Bubbles formed almost immediately at the negative pole, while oxidation took place at the positive pole. Coagulation of the albumen commenced at the point of greatest resistance, under the bubble in the centre of the tube, and gradually spread, following the bubble as it was floated from one position to another.

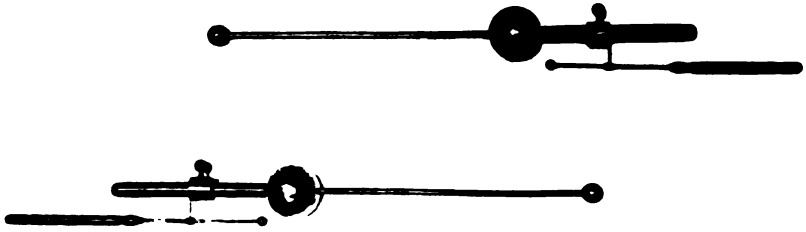
EXPERIMENT NO. 2

Same tube, same electrodes. Tube in vertical position. Negative above. Extra spark gaps open one inch on each side. Coagulation began in five minutes, and was first noticed at a distance of about two inches from the negative pole, and gradually increased toward the positive pole. After one hour's time the coagulum filled the tube. The clot was acutely cup-shaped on negative side, while the positive side was sharply convex. The reaction of the albumen to litmus paper tests before the experiments was neutral. All the albumen back of the points of electrodes on both sides was not coagulated, and gave an alkaline reaction to the litmus paper test after the experiment.

EXPERIMENT NO. 3.

Tube half-inch calibre, eighteen inches long, corked tightly at both ends, with wire contacts passed through the corks, projecting two inches inside tube at each end. The contents of this tube consisted of a solution of albumen, water, starch, and iodide of potassium. The albumen was diluted until it was filterable. The starch was boiled and filtered. The animal and vegetable colloids were mixed

FIG. 1.



Double extra spark gaps.

FIG. 2.



Treating a neuritis of the median nerve. Here the negative electrode is placed over cervical and upper dorsal vertebræ. A positive ball electrode is held in the hand.

FIG. 3.



Patient with olive-tipped electrode in each ear, attached by rheophore to the extra spark-gap sliding rods as shown in Fig. 1.

FIG. 4.



Current coming from positive side of machine, the negative side not being grounded. Double extra spark gaps closed, as this is not a double extra spark-gap current.

FIG. 5.



Abdominal muscular massage produced by opening and closing sliding rods, causing appearance and disappearance of the two shunt sparks in the patient's circuit.

and the electrolyte composed of potassium iodide and water was added. The tube was filled with the mixture, placed in a vertical position, negative above and positive below. Reaction of mixture faintly acid. The extra spark gaps were opened one inch. In a very few minutes, after the current started, flocculent masses passed up and down the tube, hydrogen bubbles collected around the negative pole, and could be seen passing freely up the tube and down, then back again to the negative pole.

The flocculent particles of starch and coagulated albumen in passing up and down the tube gradually receded from the negative pole (perhaps by gravity). After one hour no particles were nearer than two inches to the negative pole, but gathered in great quantity around the positive, and were never still, always passing up and down the tube. The positive wire turned quite dark. The reaction to litmus paper at both ends of the tube was neutral, no electrolytic change being perceptible except the hydrogen bubbles and the darkening of wire at the positive side.

EXPERIMENT NO. 4

Now the machine was stopped. The spark gaps were shortened to about half an inch and the machine set in motion again. In a very few minutes the iodide of starch began to collect around the positive wire in great abundance.

These experiments show us very clearly that, under favorable circumstances, we do get some electrolytic action from the static current, especially so from the bi-polar application of this current. They show us that colloidal material seems to be, by some process of selection, especially acted on by the static current in its bi-polar action, whether it is associated with an electrolyte or in a simple colloidal state. They show us the physical and chemical differences between short spark gaps and long ones. They show us the concentrated action of the negative current which produces the cup-shaped clot and the diffusibility of the positive current which produces the pointed clot.

The term "under favorable conditions" has been used several times in describing these experiments. These constitute: (1) A good working machine. (2) The tubes for experiment must be kept clean so that we may examine carefully the changes that take place on the

inside. (3) The atmosphere must be dry, as in a humid atmosphere the moisture gathers on the tube and much current passes on the outside instead of all of it passing through the material inside the tube.

EXPERIMENT NO. 5

Conducted on the 12th of May, 1914. The condition of the atmosphere was not so favorable as it was in January of the same year, when the other experiments were made. The tube, eighteen inches long, half-inch calibre, was filled with (colloid) egg albumen. The spark gaps were opened on each side only half an inch. After twenty minutes, hydrogen bubbles began to appear around the negative wire. Four inches from the end of this wire, bubbles (larger than the hydrogen bubbles on the wire) assembled along the side of the tube in the albumen, and after one hour's time they occupied a space two inches long. A cloudy appearance of the albumen extended back from these bubbles to one inch from the end of the negative wire; from this point back to the cork, a distance of three inches, was clear albumen. On the positive side a thin transparent cloud filled the tube from the end of the positive wire inside to a distance of two and one-half inches, where it stopped abruptly. The positive wire was oxidized and thickly covered with a wrapping of densely coagulated albumen. From a point two and one-half inches from the end of the positive wire to the bubbles, four inches from end of negative wire, the albumen was quite clear and showed no signs of having been acted on by the current. The coagulum on the negative side appeared in transparent feathery clouds, and was altogether about six inches long. After one hour, the poles were reversed and the machine was allowed to run an hour longer; at the end of that time the condition of the albumen in the tube seemed to remain practically the same as before, except for the dense coating on what had been before the positive pole. This coating under the influence of the negative current was somewhat loosened and became less dense. At the end of this hour there were still many hydrogen bubbles surrounding what had been the negative but was now the positive pole.

With these physical facts before us, we will endeavor to discuss the therapeutic bi-polar application of the static current and to show some of the measures that have been useful in our hands.

The smaller the balls used to create the extra spark gaps and the smaller the static machine that is used the less irritating will be the treatment.

Sliding rods of a six-plate static machine with extra spark gap balls (also sliding rods) attached to their rubber handles. The revolving plates of this machine are twenty-six inches in diameter. This outfit we find most useful in the treatment of certain cases of acute neuritis and also for treating the nose, eyes, and ears.

An application (from the outfit described above) to an acute neuritis of the median nerve of the left arm. In these cases, short spark gaps are thrown in circuit. The negative electrode may be either a strip of metal or a wet pad covering the vertebrae from the third cervical to the second dorsal. A ball electrode representing the positive pole may be held in the hand. We consider it better practice, however, to enclose the thumb, first, and middle fingers in a wrapping of soft lead foil and place the hand and arm in a comfortable position. It is our custom in acute cases to give very mild currents. When the patients feel the slightest sensation of the current in the hand or neck the current is reduced until the sensation ceases. The treatment lasts from one-half hour to an hour. We have been very successful in the treatment of these cases by this method. Knowing the concentrating and penetrating properties of the negative current, we place that pole over the dense bony structure overlying the deep-seated nerve centres, while the diffusible positive current is allowed to pass from the positive poles to the tender inflamed nerves lying in the soft tissues and nearer the surface.

Pain is a manifestation of a molecular disturbance of the nerve cells, and may result as a consequence of bacterial invasion of their substance, or by the absorption of toxic material, ultra-microscopic, or as the result of traumatism. In either event, a shock has been sustained as a result (we may suggest) of over-stimulation. The cells have become motionless and rounded, metabolism is suspended, pain follows and keeps up the over-stimulation until degeneration results. The remedy is to find the cause, if possible, and remove it. In any event, mild, gentle and continued soothing tonic treatment will often cause the cells gradually to resume their activity, relieve the pain, help the cells to eliminate the toxic material, and return to normal action.

Same outfit as in Fig. 7. With an olive-tipped electrode in each ear the patient is being treated for catarrhal deafness of fifteen years' duration. She has been treated every day for two weeks, alternating the poles from day to day. One day positive in right ear, the next day negative, and so on. The results in these cases while not brilliant have been good.

Not an extra spark gap current. The use of this current for therapeutic purposes, we believe, originated, as did the extra spark gap currents, in this laboratory. Here the cut shows the extra spark gaps closed, by pushing the ball of the small sliding rod close against the brass ball next to the handle of the larger sliding rods to which it is fastened. The current is taken from the positive or from the negative side, as your knowledge of the polar action of the two currents and your judgment suggest for the requirements of the case to be treated. A light rheophore is fastened to a glass vacuum nasal electrode, and this, in turn, is placed in position and the handle given the patient to hold. There is no contact from the opposite side of the machine either to the patient or to the earth. That side is left open. The large sliding rods are approximated and the machine is set in motion. The large sliding rods are then very carefully separated until the tube is fully aglow and the patient feels only a slight sensation. This treatment we have found valuable as an auxiliary to the ear treatment in cases of catarrhal deafness as well as in cases of nasal catarrh.

Glass nasal electrodes are easily punctured by the extra spark gap current. This does not seem to be the case with the larger bulb electrodes.

The double extra spark gap current taken from a twelve-plate Holtz machine (plates thirty inches in diameter), with the large ball electrodes forming the extra spark gaps at the two prime conductors. Here the sliding rods are being closed and opened, causing the current in the patient's circuit alternately to disappear and appear. One electrode (consisting of lead foil) is placed over the lower dorsal and upper three lumbar vertebræ and represents the negative pole. A large electrode of the same material representing the positive pole is placed over the liver. This causes the current to charge and discharge through the tissues between the poles, alternately producing contraction and relaxation of all the tissues between and near the poles. This

FIG. 6.



Double spark gap. The sliding rods should be closer together than shown in the cut, the strength of the current being proportional to the size of gap between them. Treatment should be started with rods close together, and they should be gradually separated.

FIG. 7.



Application of double spark-gap current with vacuum tube, showing contraction of recti muscle of abdomen.

current, both as a steady application when the spark gaps are fixed at a required distance and left in the one position, and when the sliding rods are approximated and withdrawn, causing a surging massage of the tissues, has been found valuable in those cases of gastro-intestinal stasis with torpid liver and relaxed abdominal walls. The treatment is painless and when used with caution to suit the case in hand (which nothing but good judgment can determine) the results are usually favorable. Our experiments have proven to us the penetrating qualities of this current, and its frictional activity on the colloid molecules in the presence of an electrolyte.

Clinical experience teaches us that in the living tissues we get a therapeutic reaction to this current (when it is properly selected to suit the case), which assures us that disturbed metabolism is corrected and nature is often thereby aided to restore the normal physiologic functions to the weak and diseased tissues of the body.

Shows what we have designated as the double spark gap in contra-distinction to the extra spark gaps. Here we have only one extra spark gap instead of two. Its chief use in our hands has been the treatment of certain localized areas with small hand electrodes of sponge and with the hammer-shaped glass bulb electrodes. The cut shows patient with small sponge electrode applied to the sternocleidomastoid muscle. A sponge electrode at the back of the neck completes the circuit. When the sliding rods are closed and opened a surging current is the result. Contraction and relaxation of the muscle under the electrodes follow, with a gradual strengthening of this muscle. The patient is being treated for an inequality of the muscles on the two sides, which causes an uncomfortable sensation of a constant pull against this muscle. It is always best to begin the use of this current with sliding rod balls close together and the double spark gap closed, both gaps being gradually opened until the desired contraction is obtained. If, for any cause, more violent contractions are required or desired, these can be obtained by the methods outlined above. We may also resort to the vacuum tube application of the double spark gap as shown in Fig. 7.

Here the negative electrode in the form of a strip of soft metal is placed over the spine and connected to the prime conductor of that side of the machine, while a ball electrode in contact with the positive prime

conductor forms the spark gap on the positive side. This ball electrode is connected with a hammer-shaped vacuum tube, as shown in the cut (a metal target tube is best). The flat surface of the tube is placed upon the surface of the part to be treated (in the cut the abdomen is selected). Both gaps, the one between the sliding rods and the one between the ball electrode and prime conductor, must be closed before the machine is started (if not, you are liable to give your patient a severe shock, and shocks of all kinds should be avoided). When all is ready, gradually open a very little distance the sliding rods until the desired contraction results. Then open and close the other gap at such intervals as your judgment suggests. A powerful surging contraction will result. The strength of the contraction will depend upon the length of spark between the sliding rods.

There is one thing that we who use static electricity to treat the sick should always remember: we are using an agent which is powerful for good, and, also, one which may produce bad results, and produce them in such a way that we ourselves or the patient will never know that we have caused them.

In the human body we are dealing with a very complex physical and chemical organism, composed of millions of little colloidal cells which are constantly at work and bathed constantly in the fluid electrolytes. The physical and chemical changes constantly taking place between them, known as metabolism, is the process of waste and repair, synthesis and analysis, anabolism and catabolism. These positive and negative changes taking place side by side in the cell go to make, when normally performed, what we call physiologic life. So long as all the tissues of the body are normal and functionate in a normal manner the individual is in what is known as a state of health. In this state one may endure many hardships and many shocks without serious injury. Unfortunately we do not get our patients while in a state of health. We get them when the physical and chemical properties or functions of many of the little protoplasmic masses of cells are suspended or changed; while nature is making every effort possible to regulate them and put them in order again. If, at this time, our treatments are too vigorous or misapplied, we may hinder instead of help in the restoration process. The patient does not get better, or may even get worse, and we may often be the cause

without knowing it. If our treatments are well timed and suited to the case we may gently coax and tone these little cells into action and be a help instead of a hindrance to the efforts of nature, which our experience would lead us to believe is always pulling and striving in the direction of repair of tissue and restoration of function. Our motto has always been, better do too little and feel your way to security than to do too much and destroy at once the opportunity for success.

We hope that this introduction of the use of the extra spark gap currents of static electricity may lead to a further study of the subject, and that those who may feel justified in using them may find as much or more satisfaction to themselves and benefits to their patients as has fallen to our good fortune to enjoy.

TREATMENT OF NEURITIS BY ELECTRICITY

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IN our last lecture, we spoke more particularly of the use of the sinusoidal current. R. S. McKenzie Wallis and Edwin Goodall have used the sinusoidal current in the bath, at a comfortable temperature; each bath lasting for 20 minutes. The 108 cases of insanity so treated were mostly cases of melancholia. Of these, 57.4 per cent. recovered or showed mental improvement; a large proportion also showed increased weight.

Mr. Wallis concludes:

- (1) In the insane, the excretion of creatinine is generally subnormal.
- (2) The sinusoidal bath tends to increase the creatinine in the urine.
- (3) The ordinary warm bath alone has little, if any, influence on the creatinine excreted.
- (4) The variations in volume of the urine excreted, and the great proneness to bacterial decomposition, seem to be characteristic of the insane.

One of the cases, which we treated in this hospital by means of the sinusoidal current, was a woman who had become extremely stout. She was one of the type of multiple, alcoholic neuritis. She could not move her arms upward nor sideward, and she could barely walk with a sort of shuffle. The result of the treatment, administered three times weekly for about six months, was restoration of the normal strength of arms and legs, improvement in her mental condition, and decided reduction in her adipose tissue. Indeed, her health was so far recovered that she was permitted to go to her home.

Of all the various forms of electric currents which are of benefit in the treatment of neuritis, none exceeds the wave current in value, when it is administered with a proper degree of care. The manner in which it is used is as follows:

Seat the patient on an insulated platform. This platform should be about 5 feet in length, and 2 feet 4 inches in width, and should rest on glass legs about 10 inches long. Place this platform 3 feet away from the machine and the same distance from any surrounding objects (Fig. 1).

The size and shape of the electrodes used will necessarily vary with the part to which they are to be applied. The material of these electrodes may be sheet lead or bottle-cap composition. This latter is a mixture of lead and tin, and is procurable in any thickness desired. It can be cut with shears to any size and shape required.

Dr. Titus has used pure silver for several years. It also can be obtained in any thickness. Silver is, indeed, the best conducting material for electrical currents now available. The wave current also is more agreeable when applied with silver plates.

Whatever its kind, the electrode is applied to the bare skin of the patient, care being taken that the electrode lies smoothly and evenly against the part being treated. Wherever possible, it should be held securely in place by means of a roller bandage, a pillow, a towel properly folded, or a hot-water bag. If the skin of the patient is dry, it is well to moisten it and the electrode with warm water. In some cases even wet the electrode with soap and water.

Then the electrode is connected, by means of copper wire, to the positive prime conductor of the Holtz machine. The negative pole is grounded by means of a chain to a good earth connection. The sliding rods are pushed in, until the terminal balls touch, and the machine may now be started (Fig. 2).

It is necessary to have a motor of sufficient power to run the machine at the proper speed, and a good rheostat for controlling this speed. The patient should remove all metal ornaments, and women their hair-pins particularly.

As soon as the machine is running at suitable speed, we draw out the sliding rods until a spark of sufficient length is passing. It is well to begin with a very short spark, in order to avoid giving needless pain; after the current has been running a minute or two, the skin will be moistened as the result of the stimulation of the sweat glands beneath the electrode. The part will also soon become more tolerant to the current (for reasons which will become apparent as we go on with the description of the physiological action of the wave current).

We may now increase the length of the spark. As soon as a spark of two or more inches in length is passing at the sliding rods, we notice that the patient's uplifted hair oscillates in unison with the rate of spark discharge at the sliding rods. There is also a commotion imparted to the atmosphere for several feet around the patient.

Now let us analyze what is happening. The patient's body is being utilized as a capacity. It is being charged and discharged, from the positive side of the machine, by positive electricity only (the floor and sides of the room being charged and discharged from the negative side of the machine) at the time when each succeeding spark passes through the air between the terminal balls of the machine. This spark represents the end of each cycle of opposite charges and discharges. The equilibrium of the potential of the opposite polarities is visible to us by reason of this spark.

The thickness and noise of the discharging spark is dependent upon the height of potential to which the opposing capacities have risen. This height of potential is dependent upon the size and shape of the terminal balls. The larger the ball, the higher the potential will rise before the equilibrium is established. With a very small ball the rise of potential will be very much less. These balls may be obtained in different sizes from $\frac{1}{2}$ inch to $2\frac{1}{2}$ inches in diameter. They can be secured and removed, on and off, at the terminals of the sliding rods (Fig. 3).

Every time a spark passes there is a commotion, not only in the air surrounding the patient, but also directly under the electrode, in the underlying and surrounding tissues. The higher the potential to which the patient's capacity has risen, the more extensive and the more energetic will be the resulting perturbation in the tissue.

During the period in which the patient's body is charging, the current does not simply accumulate on the surface, but passes into the tissues beneath the electrode, and then gradually diffuses itself throughout the saline fluids of the body. The dry skin on the outside of the body presenting much greater resistance to the passage of the current, it is only fair to assume that the electricity will be conducted along the paths of least resistance. When the body is fully charged, and the equilibrium of the opposite potentials is again re-established by the passage of the spark at the sliding rods, the current rushes out again along the path where it entered. We have here, then, a true

FIG. 1.



Mild resonator sparks and spray.

FIG. 2.



Brush discharge applied to a case of herpes zoster of the neck.' "

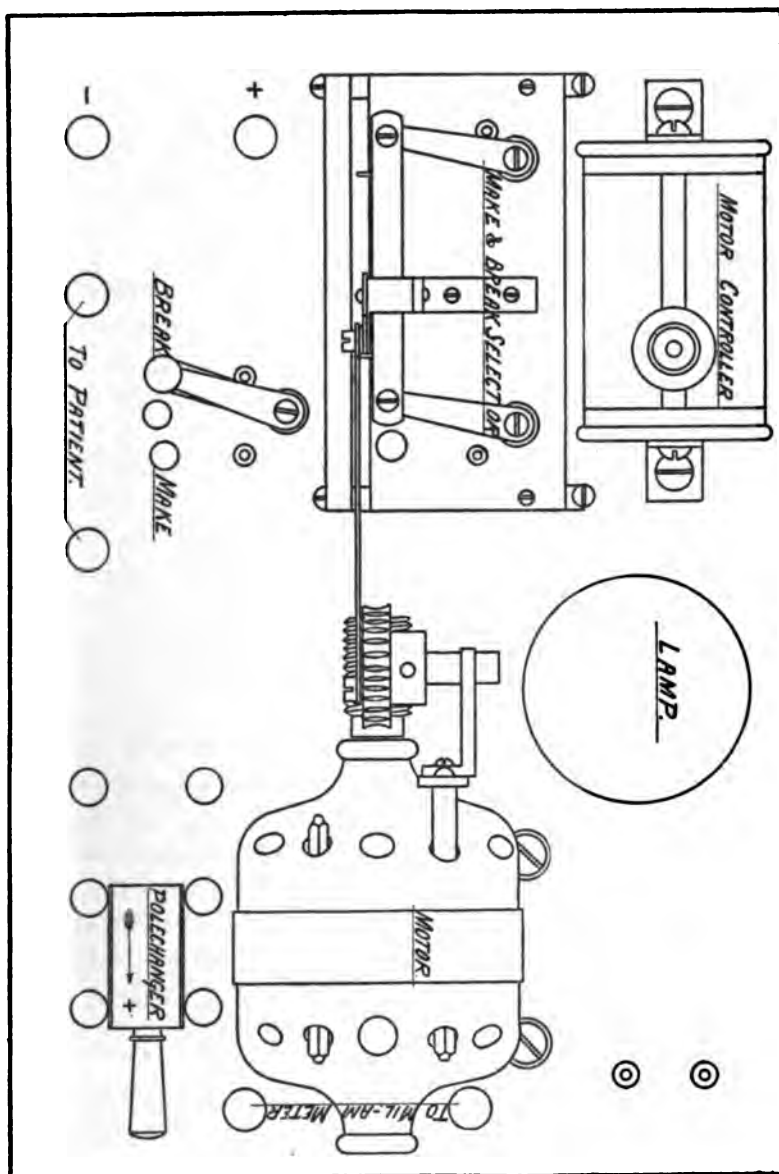


FIG. 3.

make and break of a current of high potential and small quantity. The physiologic actions obtainable thereby obey all the laws applicable to the galvanic current.

The most important effect of the wave current is contraction in all the tissues, which can be made to contract in response to electrical currents. This contraction occurs at the break of the current, during the passage of the sparks across the air gap between the terminals of the sliding rods. Each contraction is followed by a period of relaxation. The rapidity of the passage of the spark governs the rate of alternate contraction and relaxation. If too rapid, the tissues are thrown into a condition of tetanic contraction. It is desirable that not more than 300 sparks should pass per minute. The slower the rate of spark discharge, the more nearly will be approached the effects we referred to, when we were describing the action of the sinusoidal current.

This rhythmically alternate contraction and relaxation effects tissue drainage and an altered state of the circulation of blood and lymph. As a result, we have relief from venous stasis, and relief from irritation of the endings of the sensory end-organs of nerve fibres through removal of mechanical pressure. Muscular relaxation also follows from the same causes in previously contracted muscles.

In employing the wave current for the relief and cure of neuritis, it is of the utmost importance that an electrode, of suitable size and shape, be applied at the exact spot where it will do most good. For instance, in neuritis of the brachial plexus, the greatest permanent benefit is obtainable by placing an electrode over the end of the shoulder in such a manner that it covers the scapular muscles, the point where the clavicle and scapula join, and the cervical portion of the brachial plexus. In this way, we affect the most important portion of the brachial nerves, the articulation of the shoulder joint, and the muscles that move this joint. The numbness of the fingers, so often present in these cases, and the pain and stiffness in arm and shoulder, frequently disappear after a very few treatments.

Many persons suffer from pain in the shoulder and arm as the result of chronic, passive congestion of the liver. They are usually told they have "neuritis." An application of the wave current, with the metal plate over the liver, will usually give instant relief.

It is not at all uncommon to find an enlarged and tender prostate

in men who come to us for intractable shoulder pains. In these cases it would be useless to apply the wave current to the shoulder. If, however, the wave current is applied, by means of a metal electrode in the rectum, against the prostate, the tenderness and swelling of this gland will disappear, and with it the pain in shoulder and arm. The reason for this would seem to be as follows. The prostate often harbors the remnants of some previous infection, and serves as a centre of distribution of microscopic organisms into distant parts. A sudden wrench of the shoulder, ordinarily a temporary source of discomfort, is sufficient to set up a low inflammatory, perhaps a congestive, condition in those whose prostate harbors disease-bearing bacteria.

Hilton, in his book on "Rest and Pain," calls attention to an important point which may often help us formulate an intelligent and successful plan of treatment in neuritis, not only of the brachial plexus, but also in sciatica. He states it thus: "The same trunks of nerves, whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertions of the same muscles; and, what at this moment more especially merits our attention, the interior of the joint receives its nerves from the same source."

The application of the wave current with the metal plate over the shoulder, in the manner previously detailed, would make it possible for us to gain all of the physiologic actions of the wave current on the joint itself and on the sensory and motor nerves. The rationale of the method is apparent. Many persons suffering from brachial neuritis suffer from irregular forms of gout, from deficient elimination, and from so-called rheumatic conditions.

The use of high frequency currents in these cases fulfils certain definite indications. By means of the glass vacuum electrode attached to the Oudin, we can quickly produce a prolonged hyperæmia of the skin. If we watch a glass vacuum electrode, fully excited by an Oudin current from a transformer, we will be struck by the similarity of the cathode stream, within the tube, to the static brush discharge.

Hundreds of very fine sparks strike the skin at the point of its contact with the glass electrode. As the direct result of these sparks, we get the secondary hyperæmia. And, as a further result of the extremely rapid vibratory effect imparted to the tissues by this hypotensial current, we have a more or less complete arrest of the pain

impulse. A prolonged application produces an altered state of the circulation of the part, resulting in removal of venous stasia.

The bipolar d'Arsonval current (Diathermy, or Thermopenetration) may be used to advantage in brachial neuritis. The method of procedure employed is the use of a large indifferent metal plate attached to one side of the d'Arsonval spiral and applied to the dorsal spine. The other, a smaller electrode, is the active electrode. This is attached to the other end of the d'Arsonval spiral. Now apply the active electrode to each painful spot in turn, warming it thoroughly, until the entire shoulder is warm and free from pain. This method produces, as a direct result of the warmth introduced, an intensification of the flow of blood and lymph. This is attended by no electrolytic effect. The relief of pain follows and is the result of this impartation of warmth into the tissues, which is accomplished without the expenditure of any of the patient's stored-up energy. The extremely rapid rate of the oscillations rushing through the tissues also has a pain-relieving effect.

It is important to remember (though the patient's sensation is usually a good guide by which to measure, in a degree, the effect of the current) that it is necessary to use great care over areas likely to be anæsthetic, or whose sensation to heat and cold may be altered. This is particularly to be borne in mind when employing the diathermic method for the relief of the lightning pains of tabes. The anæsthetic condition of the skin, together with the lowered reflex activity, may easily lead to an overdose, and a resultant burn. Such burns are apt to be deep and to heal slowly.

Practically all that we have said about the treatment of brachial neuritis is applicable to the treatment of sciatica. In using the wave current, we apply the metal plate over the sciatic notch.

William Bruce, in his book, "Sciatica," calls attention to the very frequent (in his estimation, constant) occurrence of articular changes in the hip-joint of the leg affected. He bases his opinion on the result of an analysis of 676 cases during a period of 23 years. The wave current over the sciatic notch has resulted in the cure of so many cases of sciatica, and the uniformity of the results obtained by many different men has been so constant, that it would appear to be the method that should be pursued by all.

When we remember the physiologic effects of this current, we can readily understand how the disappearance of the muscular spasm of the pyriformis and other muscles would be coincident with the altered condition of the joint.

There are, however, some cases that do not yield to the application of the wave current over the sciatic notch. In these, other elements enter into the etiology of the trouble. While gout and rheumatic conditions are a predominating factor in sciatica, we also find a history of a remote strain, either involving the hip-joint or even an actual stretching of the nerve.

Again, there may be sciatica as the result of bruising of the sacral plexus by the forceps during labor. Prolonged sitting on a small seat as a shoemaker's or coachman's seat; constrained position for long hours, as in drivers of motor cars, may be productive of a peculiarly obstinate form of sciatica.

Syphilitic disease of the nerve is not so very uncommon. Sciatica may follow fracture of the femur or occur as the result of scar tissue. To this group belong the ischialgias which we find after amputation. Necrosis of the tibia may be productive of sciatica years after a sequestrum has been removed. Gonorrhœal rheumatism of the hip-joint may give rise to sciatica. In these latter cases, the diathermic method is valuable. To practise this, we place an indifferent metal plate electrode, size 10 x 12 inches (and attached to one end of the d'Arsonval spiral), over the gluteal region, and apply a smaller active electrode (attached to the other end of the d'Arsonval spiral) to the front of the thigh. We use just enough current thoroughly to heat the skin, beneath the active electrode, to the point of greatest tolerance. Then apply this active electrode in like manner to another spot and so continue until every bit of skin surface has been thoroughly heated. Our aim is to heat the joint from different angles. The bipolar d'Arsonval current passes through the tissues in a perfectly straight line. If we warm the joint from different sides, these lines of heat will meet in the interior of the joint, so that it is possible to raise the heat in the interior of the joint to a very high point. As the result of this heating we kill the gonococci and check their toxins.

There is an element of danger attached to this method. We may succeed, if we are not careful, in damaging the joint, though the outer skin has reached only a state of comfortable warmth. It is well

to bear this fact in mind whenever we diathermatize a joint from many sides.

Occasionally we see cases of sciatica which are true neuritis of peripheral origin; sometimes of rheumatic, and again of obscure origin. Such a case came under the writer's care, about seven years ago, in the person of an engineer, aged 54 years. This man had been working in a damp place and was frequently wet to the skin for hours. His hours of labor were long and his work excessively hard. After years of this exposure, he contracted a neuritis of the anterior tibial nerve. This travelled rapidly upward. He went to a hospital, where he remained for four months. Many methods were tried to relieve him of the intolerable pain, among them the "baking" method. Nothing eased his suffering. His leg and thigh became greatly emaciated. He left the hospital and was brought to my office. The atrophied muscles showed electrical changes of a quantitative and qualitative kind. There were areas of anæsthesia and areas of hyperæsthesia. We applied the high-candle power light with a view to warming the atrophied muscles and inflamed nerves, and to flushing the blood-vessels to the limit.

Following the light, we applied the glass vacuum electrode attached to the Oudin from a coil. Our object was to stimulate the skin reflexes, and through them the vasomotor nerves. His leg became warm in fifteen minutes after we began treatment. We then applied the blue pencil brush discharge all over the bare skin of the leg. The entire treatment consumed about an hour. He went home free from pain. A daily repetition of this plan of treatment for two weeks restored him to complete health. There has never been a repetition of the neuritis in his case.

Previous to his attack, this man had never suffered from any serious illness. Great care had been taken to arrive at an accurate diagnosis. There was no doubt of his trouble being a true case of neuritis. He presented a typical glossy skin and atrophied hair follicles. His leg had been cold for months. Not even the "baking" process had warmed it, though a fever was brought about after one of these "bakings," which could not be checked for many days.

The use of the galvanic current in sciatica has been attended with a full measure of success. Many acute cases are cured in three or four treatments. The best method of application is to place the posi-

tive electrode over the sciatic notch and the negative pole to the foot. For the positive electrode, it is well to use as large an electrode as will amply cover the sciatic notch (about 3 x 4 inches). For the negative electrode, we use a foot basin filled with warm water. It is well to begin with a weak current, about 5 milliampères, and gradually increase it to about 20 milliampères. Too strong a current, at the beginning of the treatment, may aggravate the trouble. Later, as our patient improves, we may increase the current strength to 30 or even 40 milliampères. The duration of the treatment should be about 15 minutes at the beginning; gradually lengthen to 30 minutes. This should be repeated at first daily. As improvement occurs, the intervals between treatments should be lengthened.

The faradic current should be scrupulously avoided in all cases of true neuritis. It is very apt to aggravate a case. Yet to every rule there is likely to be an exception. Among my early triumphs was a case of sciatica in a shoemaker. This man had suffered for months. He had tried many remedies—the hypodermic injection of morphine and atropine, the hot flat iron, static sparks, and the galvanic current. Every time the galvanic current was applied to his nerve he became worse. No internal medicine had the slightest effect. We applied, to his perineum, a large sponge electrode, attached to one side of a long wire secondary induction coil; and applied to his spine, by the labile method, the other electrode, which was also covered with a large sponge. The man improved at once, and was well after a very few treatments.

This man's sciatica was the result of the constant pressure exerted upon the nerve by sitting on a hard, old-fashioned shoemaker's bench. While the method employed did not submit the sciatic nerve to direct stimulation, yet it doubtless helped restore the normal tone of the vascular supply of the nerve centres at the spine. In this way, the pathologic process, which had resulted from the prolonged compression of the nerve and its sheath, was removed.

Among other forms of neuritis, which come to the electrotherapist quite frequently, is peripheral facial palsy. In these cases, it is unwise to test too arduously for the reaction of degeneration. Repeated contraction of the muscles soon tires them. The fatigue thus induced deprives the paralyzed muscles of much of their vitality. This is particularly true of the faradic current. It must never be

used until every trace of active congestion or inflammation has subsided. The diathermic method, using a large metal plate electrode on the face and a very large indifferent electrode on the spine, has been the most successful one we have ever used.

We should employ just enough current gently to warm the face. If this is used early, it will remove the venous congestion and keep up the arterial blood flow in the paralyzed muscles, thus helping to maintain their nutrition and prevent the retrograde changes in the muscles, which result from the interference with the nerve supply.

The rousing of normal circulation of blood and lymph, as the result of the vivifying warmth of the diathermic current, cuts short the inflammation of the nerve. It is early in a case of facial palsy that measures based upon sound reasoning have a chance to prove their merit, before injudicious attempts at treatment have been made and before permanent damage to nerve and muscle has occurred.

The wave current may also be used, but should be employed with a proper understanding of its physiologic actions. It must be used mildly, and care must be exercised that the contractions of neighboring muscles (those of the neck, for instance) be not forcible enough to shake the head.

We spoke of the resemblance of herpes zoster to neuritis. If a case comes to us early, we can do much to relieve the distressing pain and can usually shorten the course of the disease by employing the diathermic method.

The method of procedure is as follows: A metal plate, 8 by 10 inches in size, is placed over the site of origin of the nerve or group of nerves affected, and then attached to one side of the d'Arsonval spiral. Another metal plate, large enough to cover the peripheral area of the distribution of the affected nerves, is applied and attached to the other side of the d'Arsonval spiral. Current enough gently to warm the parts beneath, about 1000 to 1800 milliampères, is allowed to pass for fifteen to twenty minutes. It is best to apply the metal plates directly to the bare skin and to begin with very little current, about 500 milliampères. In this manner the current will find its way gradually and evenly through the tissues. The skin will also become slightly moist, much in the manner we noted when speaking of the wave current.

I would caution against the practice advised by European authors.

This practice is to cover the electrode with some material which is previously moistened. The objection is this. When the current is turned on sufficiently strong to produce a quick heat, this moisture becomes warm and may easily be converted into steam. Blisters can thus be produced.

The moisture which is produced as the result of the stimulation of the sweat-glands has never been objectionable. The reason for this seems evident. The sweat-glands, being thoroughly aroused, are widely open, thus favoring the easy entrance of the current. This moisture is constantly and naturally reproduced as it is used up. At the same time, the warming effect of the current results in the widest possible dilatation of the capillaries. The activity of the circulation beneath the electrode is greatly accentuated. The cooler blood stream tends to keep the skin cool at first, and, later on, prevents too great a heating of the part.

We should also bear in mind the importance of current density. If we employ a pair of metal disk electrodes, size $1\frac{1}{2}$ inches in diameter, a current of from 300 to 600 milliamperes is not bearable for more than two or three minutes; whereas the same amount of current, employed with metal plate electrodes size 6 by 8 inches, will feel pleasant for ten or fifteen minutes.

The diathermic method is to be followed by the application of the blue-pencil brush discharge for fifteen or twenty minutes. We have frequently aborted an attack in two or three treatments.

When, however, the disease has lasted for weeks and months before the case is presented, the problem becomes a much more difficult one. Such patients often suffer very severe pain both day and night. The skin, where the herpetic patches first made their appearance, will be found greatly changed. It is usually thickened considerably. Similar changes must also occur in the sheaths of the affected nerves and their roots, for we find the nerve-trunks tender to pressure.

The application of the high candle-power light, while helpful in the early stage, is of little or no value now. It will, however, so redden the skin as to bring distinctly to view the site and extent of the old herpetic patches, outline their contour, and give us a better idea of the degree of infiltration that has taken place.

Under these circumstances, the following plan of treatment is the one which has yielded the best results: We saturate sixteen layers of

surgical gauze (made into a pad slightly larger than the electrode which we wish to employ) with a solution of sodium salicylate, attach the electrode, so padded, to the negative pole of the galvanic current, and place it over the peripheral distribution of the affected nerves.

A similar pad of gauze is saturated with quinine muriate solution for the positive electrode. The positive pole is applied to that part of the spine where the affected nerves have their origin.

The amount of current strength employed will vary with the size of the electrode. The question here is again one of current density. The weakest current that will do the work is the one to use. Although a current that feels comfortable at the beginning is employed, we must still give proper attention to such details as the even application to the skin of the electrode and the underlying gauze, and the recognition of every slight skin abrasion or scratch, etc.; for neglect of these details may easily lead to the production of a burn—a galvanic sore, painful and slow to heal.

A mild current for thirty minutes will give great relief and avoid the danger referred to. It has been our experience that the mildest galvanic current will be beneficial in neuritis, whereas one only slightly stronger will aggravate the trouble.

A number of cases of true neuritis of the brachial plexus came under our observation many years ago at the German Poliklinik. One milliampère of current applied with the usual sponge electrodes, one at the neck, the other to the inside of the arm just above the elbow, served to alleviate the pain and help nutrition of muscles, skin, etc. One day an assistant concluded a stronger current would be better. He used five milliampères. The patient at once became worse.

These mild currents employed in the manner described will drive in the salicylic ion and the quinine ion and will help to remove the infiltration in the skin.

Technic, attention to the minutest detail, is nowhere, not even in surgery, of more importance than in the application of electricity. This technic cannot always be described in mere words. It can be mastered by long and patient attention to the minutest detail under the guidance of one who is proficient, or by close analysis of one's own mistakes and successes.

Whenever we are using the galvanic current for the purpose of ionic medication we should be careful to have the skin to which the

electrodes are to be applied surgically clean. The gauze should never be used twice; it should be sterile.

There are few disorders that have resisted our efforts more than tic douloureux. The X-ray has frequently been successful in checking the paroxysms; so have other measures, such as the internal administration of aconitia, etc.

The great majority of cases of tic douloureux have found some relief, temporarily, by means of the various measures employed, only to relapse again into their former pitiful condition. We know a man who had his gasserian ganglion cut by a most skilful surgeon. Gradually other nerves were excised, all his teeth were removed, and still he had the most frightful paroxysms.

In these cases the salicylic ionization has been the means of greatly benefiting a number of hopeless cases. We place the positive electrode over the cervical vertebra and the negative electrode over the peripheral distribution of the nerves. The salicylate of sodium solution is placed under the negative pole and the quinine muriate solution under the positive pole, following the method previously described.

THE VALUE OF ELECTROTHERAPY IN MENTAL AND NERVOUS CONDITIONS

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Among the foremost authorities in neurology and psychiatry there are conflicting ideas as to the value of electrotherapy and other physical therapeutic measures. In the textbooks on these subjects one is able to find little or no favorable comment; some authors do not refer to the subject, and others condemn its use. Some advocate a trial in certain conditions—that it may be useful. When, however, one considers carefully the various types of electric currents which may be employed, the various modalities of each, and the variety of physiologic action one is able to produce, the practical and efficient results that are to be obtained with proper selection of modalities to meet the action demanded, the pleasant and agreeable methods of administration, it seems that the entire subject is of more importance and deserving of more consideration in aiding the many nervous and mental states than has generally been admitted. The employment of electrotherapy here at the hospital has been productive of results which impressed upon me a very favorable attitude regarding its value and beneficial influence upon conditions met with in the patients.

While heredity, general make-up, psychic trauma, conflicts, etc., are known to be each a factor in various abnormal and nervous conditions, it is a failure in the physical state as an external factor which plays such an important and many times principal rôle in the development of the disorders. The physical state is again further impaired during the course of the disorder. General disturbances arise, including inhibition in functions, involving the nervous, glandular and muscular system, so frequently observed in many depressive states. Exhaustive conditions develop, the result of toxæmia or prolonged excitements, etc. In these and the many other disorders of the physical

state electrotherapy is of value. While the various currents are adapted to definite pathologic conditions and are employed with the idea of a definite physiologic result, there is a distinctly favorable psychic impression created many times, and confidence is established, this being in the nature of suggestion, which has a very beneficial action.

Let us consider briefly the currents, with some of their modalities and physiologic action :

The static current is the oldest. This form of current has probably been used more indiscriminately, and with less regard to local or general physiologic effect, than any other. The use of the static current is dependent upon the fact that all bodies have a definite potential or a capacity for electrical charge. Static electricity has the property of accumulation on the surface of charged bodies. Thus, when a patient is properly connected, there is an accumulation on the surface of the body to a certain potential, then a disruptive discharge of the excess. This action results in general vibratory effect, and in irritation of the sensory peripheral nerve endings, the final result being a stimulation of the motor nerves with contraction of the general muscular system. There are practically no thermic or electrolytic effects, the action of the static current being mainly mechanical, with the production of small amounts of ozone. This is said to stimulate the formation of red blood-corpuscles, and to increase oxygen absorption and the reducing power of the hæmoglobin. The rate of interruptions must be less than 600 per minute, for beyond this tonic contraction takes place. Thus, by means of the static discharges, a general stimulation and tonic effect is produced. The muscles and tissues are exercised gently, as by the wave current, or more forcibly by the use of condenser discharges, the resonator effleuve, or sparks. The number, force and general character of the contractions produced may be varied and made to suit the physiologic action desired, from mild stimulation to powerful action. Better muscular tone is produced, and the circulation is aided by the action of the current upon the vessels, and also because of the comparison of the muscular upon the vascular system. As a result there is an influence brought to bear upon local conditions, inflammatory products are driven off by way of the lymphatics, and hepatic, prostatic, neuritic, splenic, uterine and other local congestive conditions are relieved. There is a general

reflex stimulation of the sympathetic nervous system with a helpful influence upon intestinal movements and general glandular functions.

Exaggeration of the general effects is attained locally by the application of suitable electrodes, or by leaking the currents off at parts of the body, and in this manner the various violet rays are produced. These have actinic and antiseptic action, the therapeutic value resulting from the better circulatory states with phagocytosis, and from the actinic value in the ray itself. By reason of the general cellular and molecular activity there is a tendency for the tissues to throw off their catabolic products, and with the new food taken up there is a decidedly good influence on general metabolism. Following application, the urine is shown to contain increased urea, with decrease of urates, uric acid, etc. So in rheumatic and gouty states excellent results have been obtained. In conditions with a general disturbance of metabolism, as at the menopause, or in which general muscular, nerve, or glandular improvement is sought, these currents are beneficial, and induce normal function. In many of the depressive states treated here electrotherapy has been a potent factor, I believe, in aiding convalescence. Relief from general restlessness has resulted, patients have slept better, menstruation in many has been re-established, constipation with various gastric disorders relieved, and patients with complaints of unknown causes, somatic ideas, have been quickly improved. Alcoholic neuritic conditions have been benefited, muscular tenderness has disappeared, muscular power has been improved, and correction of deformities has taken place. One neurotic condition, probably the result of autotoxæmia with marked vasomotor disturbance, mottling and cyanosis of hands and legs, general poor nutrition and blood pressure of 78 mm.—showed prompt and decided improvement, with disappearance of pain, return of muscular strength, and elevation of blood pressure to normal in about three weeks. In the course of about six weeks there was a gain of 50 pounds in weight. In a case of trifacial neuralgia, resulting from dental caries, there was immediate relief following treatment. In varicose veins, relief from pain and decided improvement in circulation has resulted. Static currents are useful in disturbances of blood pressure, which, whether high or low, approaches normal. The wave current, brush discharge, and resonator effluve with moderate degree in rapidity of action have been employed in these cases, the modality

being varied to meet the condition present. Sparks and condenser charges produce more powerful contractions and are not quite so agreeable.

Let us briefly review the direct or galvanic current and the variety of currents derived therefrom: faradic, sinusoidal, and the various high tension alternating and unidirectional currents, with the varying potential and milliampère as required for various effects; also the various types of radiant energy whose actions are dependent upon their wave length and velocity—the shorter the wave length, the less penetrating, but the greater energy production. The general physiologic action is dependent upon the length of exposure and the energy production, and varies from mild tonic action to complete inhibition of function and destruction of tissue.

As a therapeutic agent the galvanic has polar, interpolar, and general effect. To summarize the polar effects as a result of decomposition of tissue by electrolysis, acid ions accumulate at the positive, and alkaline ions at the negative pole. With sufficient currents, caustic effects are produced. At the positive or acid pole, metals affected by acids are decomposed and salts of the metal are produced. Salts of copper, zinc, and other oxide metals are thrown into the tissues. A drying is also produced. The positive pole is sedative to sensory endings about it; it is a vaso-constrictor. Bacteria are destroyed as the result of its action (metallic salts). At the negative pole, there are accumulation of fluid, liquefaction, and an alkaline caustic effect. The negative pole is irritant to nerve endings; it acts as a vasodilator.

The interpolar effects are electrolysis and transference of fluids from the positive to the negative pole, and cataphoresis. The general effects are tonic.

Stimulation of cutaneous nerves by faradic currents produces contraction of voluntary and involuntary muscles. It is rather irritant to nerve endings and can be combined with the galvanic, when there is an increase of action due to faradization of parts whose excitability has been increased by the action of the galvanic current. There is then less fatigue and exhaustion, because of the refreshing action of the galvanic current, fatigue being caused by improper combustion or accumulation of products of combustion, and avoided by the better circulatory effect produced by the galvanic current. The contractions are more forcible and penetrating, and the current used combined

where deeper action is desired. Either current may be employed for general or local effects.

The sinusoidal produces uniform increase or decrease of electromotor force with inversion of polarity. There is little sensory effect, but a gradual contraction and relaxation of muscular structures; and, where rebuilding and restoration of lax muscular conditions are desired, the sinusoidal is the most effectual of currents. There is a squeezing out of effete products with absorption of new material. Effects of galvanic, faradic, or both, may be had with the sinusoidal.

A girl of about 23, in a state of depression—reduced activity and marked complaint of weakness; general lax musculature, as shown by drooping shoulders, scoliosis, and constipation—showed decided improvement in general health and weight, relief from constipation, the shoulders thrown back, and the scoliosis so near to correction as to be barely noticeable. There was also a return of menstrual function in this case, with general improvement and recovery from the depression. She received two or three twenty-minute treatments for two months with combined sinusoidal, the electrodes being placed over the upper thorax and the vertebræ and over the abdomen.

High frequency currents, or high tension alternating currents, have been made adaptable for therapeutic use only within the last few years by the employment of various coils and solenoids with condensers. The therapeutic value is dependent practically upon the thermic effect produced without mechanical or electrolytic action. The thermic value is accounted for perhaps by the resistance of the tissues to passing electrons; also to general molecular oscillation. The thermic effect may be varied at will up to the point of tissue dehydration, destruction or actual combustion. The application of the d'Arsonval current by means of auto-condensation is the general method in use for making general applications of high frequency current. It may be comparable to the static currents in that there is an accumulation of current toward the surface of the body. Warmth is produced with a sedentary effect upon the nerve endings and upon the vasa vasorum. There is also an effort to maintain the normal bodily temperature, with the result that peripheral vascular spasm is relaxed, and congestion in the splanchnic, cerebral, and other deeper areas relieved, with improvement in the general circulation. The heart's work is diminished, the vessels are relieved of their tension, and

there is relief from the force of the circulation upon the terminal vessels, as in the kidney, with a general helpful effect upon musculature of the vessels themselves, so that application of this current, with proper diet and hygiene, should be valuable in the prevention of sclerotic conditions.

By application of suitable electrodes more local effects are produced. For example, by placing an electrode about the knee or chest connected to one side of the d'Arsonval spiral, the other side being connected to the chair, there is a general exaggeration of effect upon the local part. With an electrode on both sides of the knee or chest, there is more decided local effect. By the size of electrodes the greatest amount of heat and energy can be focused to definite depths. It acts as a sedative upon local irritations and painful conditions with increased circulation, and improves oxidation and local metabolism. It increases phagocytosis, as the result of active hyperæmia, and also granular secretion. By means of the effleuve, there is production of the various ultra- and blue-violet rays, these having inhibitory effects upon bacteria and toxins, and yet stimulating phagocytosis. Good results have been obtained in certain local infections and in toxic arthritis.

In the treatment of nervous and mental disorders, I believe more use can be made of electrotherapy than is generally thought of at present. Careful consideration of the physiologic action desired, and proper applications, should render electrotherapy not only useful, but indispensable in rebuilding and maintaining the physical condition, and in aiding the mental state. It is, at least, worthy of consideration in conjunction with other general methods of treatment.

Surgery

THE SURGICAL CLINIC OF JOHN B. DEAVER AT THE GERMAN HOSPITAL IN PHILADELPHIA

BY P. G. SKILLERN, JR., M.D.

Philadelphia

OF the great surgical clinics, that of Dr. John B. Deaver at the German Hospital in Philadelphia is one of the most popular, instructive, and interesting. Here a wealth of material, chiefly abdominal, presents itself for study. The operating days are Monday, Wednesday, Thursday (for classes from the University of Pennsylvania), and Saturday, from one until six o'clock in the afternoon. From October until April the Saturday afternoon clinics are attended by students from various medical schools in the city. A glance through the visitors' register shows that pilgrimages are made by physicians from afar to this mecca of abdominal surgery. A typical operating-list is reproduced (Fig. 1), and it is doubtful if a larger number of abdominal operations is performed by any surgeon in the world.

The surgical amphitheatre (Fig. 2) occupies a rotunda annexed to the main hospital building. Ample illumination is afforded by a large skylight by day, and by tungsten incandescent lamps in holophane shades by night. Ventilation and pure air are provided by a special fan system. The walls are tiled, and over each door is the admonition: "*Noli loqui! Noli tangere!*" Marble seats arranged in four tiers accommodate the spectators, and the students' entrance is from the rear. The floor is of fine mosaic. The patients are etherized in an anteroom, the entrance to which is shown in Fig. 3, just to the right of the distilled-water fountain. The ventilator is at the left. To the right of this entrance is a doorway that leads into the instrument room, and adjoining this are the sterilizing room, the surgeons' lavatory, and a small office. Alterations are being made so that patients may be anesthetized in the privacy of complete seclusion from disturbing factors.

The photograph (Fig. 2) was taken at the beginning of an afternoon's work. To the right of the operating table is shown the gauze table, and to the left the empty instrument table. To the left of this is a screen, beyond which the supply tables for reserve instruments are located.

In the next photograph (Fig. 3) the operation has been begun. Dr. Deaver has just made the incision. Opposite to him stands the first assistant, Dr. Phillips;* to his right, seated on the marble rail-

FIG. 1.

OPERATIONS FOR MONDAY, JULY 6, 1914.

2 Pr. Fibro-adenoma Left Breast	(Michner)	12.45 P.M.
2 Pr. Carcinoma Right Breast	(Maitland)	1.00 P.M.
4 Pr. Pyloric Obstruction	(Bray)	1.30 P.M.
2 Pr. Chr. Appx.	(Meyer)	2.00 P.M.
3 Pr. Ventral Hernia	(Hobensack)	2.15 P.M.
2 Pr. Carcinoma Left Breast	(Weinstein)	2.40 P.M.
4 W. Chr. Appx.	(Creeden)	3.10 P.M.
4 Pr. Common Duct Obstruction	(Carlitz)	3.25 P.M.
1 W. Right Renal Calculus	(Stueczka)	4.05 P.M.
1 W. Cystic Goitre	(Fortria)	4.30 P.M.
3 W. Incomplete Abortion	(Delizzio)	5.00 P.M.
3 W. Epithelioma Lip	(Eddinger)	5.40 P.M.
2 Pr. Acute Appx.	(Mueller)	5.55 P.M.
1 W. Appx. Abscess	(Lawrence)	6.10 P.M.
1 W. Appx. Abscess	(Ganley)	6.30 P.M.
3 W. Right Empyema	(Porr)	6.50 P.M.

Typical list of operations in Dr. Deaver's Clinic. Copies of each list are distributed to visitors that they may follow the operation more closely.

ing, is the second assistant, Dr. Dickson; while the third assistant, Dr. Walker, stands just behind the etherizer, Miss Rapp, who is giving ether by the open-drop method. In the background is the nurse in the act of passing gauze, and the nurse whose duty is constantly to renew the fresh distilled water in the rinsing basins, one of which is shown on the right. The operating table is drawn close to the seats, so as to afford the best possible view to the spectators, and it may be said that almost every seat offers a splendid view of the operation. The operative field is surrounded by four towels, which it is Dr. Deaver's custom to lay on personally. Upon a fifth towel are placed

* The first assistant changes every three months, each of the three surgical internes serving nine months in all on this service. One has charge of the private patients, one of the women's ward, and the third of the men's ward.

the instruments, of which there is at hand always the smallest possible number.

Once begun, the operation proceeds with machine-like precision, and is finished with the utmost celerity and dispatch. There is not the slightest hesitation on the operator's part as to how to deal with the problem before him. Scarcely a word is spoken to the assistants: they anticipate every want. Anaesthesia to complete muscular relaxation, efficient wound-retraction, a copious supply of sponges, constant changing of the rinsing basins, and sufficient illumination are insisted upon. It is astonishing how little blood escapes. When the operation is finished, the table is rolled out and the next patient, already etherized, rolled in on a second table. After a few minutes' lapse, in which the gloves, gowns, and instruments are changed and the floor is mopped, the next operation is begun, and it is not very long before the command to etherize the next patient is given. The reporter has repeatedly seen a chronically diseased appendix removed in three and a half minutes from the time the incision is begun until the last stitch is inserted; a gastro-intestinal anastomosis performed in fifteen minutes, actual sewing time; and a radical operation upon a hernia or a carcinoma of the breast, a goitre removal, a simple gall-bladder case, or a supravaginal hysterectomy seldom require more than twenty minutes. More time is required when there is extensive suppuration, as in peri-appendiceal or pelvic peritonitis, where haste is made slowly. An hour is occasionally consumed in a complicated or tedious operation, as in subtotal gastrectomy followed by gastro-enterostomy. And so at the close of the afternoon's work, after witnessing from ten to twenty operations, the spectator leaves well pleased with his visit.

It is interesting to watch the small scalpel known as the "Deaver knife" cut through the thickest abdominal wall with two or three light, rapid strokes. The blade is scarcely more than an inch in length and about three-sixteenths inch in height. The "Deaver incision for appendicitis" through the sheath of the right rectus, and pushing the muscle inward, is frequently employed. During the course of the operation frozen sections are requested in the more important cases. The laboratory being in an adjacent building, the report is returned within a few minutes, and the course of the operation planned accordingly.

FIG. 2.



Surgical amphitheatre with operating-room staff at the beginning of an afternoon's work. (See description in text.)

FIG. 3.



Surgical amphitheatre, showing the pit and the beginning of the abdominal incision in the first case.

Doubtless much of the success of this clinic is due to the careful pre- and postoperative treatment. Previous to operation a thorough study of the case is made, both clinically and by all the efficient laboratory methods. Photographs are taken of interesting cases. Medical cases are carefully excluded and very poor operative risks avoided. In deciding between the use of ether for anaesthesia and stovaine intraspinally (which is very rarely used), the heart, lungs and kidneys are studied for organic disease and estimation of function. Should the pulse be weak, the careful use of digitalis prior to operation will often save much anxiety afterward. Morphine is studiously avoided, as it masks the symptoms and gives a false sense of security. If the kidney excretion be either deficient in quantity or altered in quality, it must be improved before operation, lest renal insufficiency supervene afterward. If the copious ingestion of water does not give rise to free diuresis and the passage of approximately normal urine, it is often supplemented by hypodermoclysis, saline enemas, or continuous proctoclysis. The quality of the urine is not of so much importance as the quantity. After operation, position, stimulation, saline by continuous enteroclysis, lavage of the stomach, restriction of food (no food by mouth), and other such measures are employed as indicated. Much credit is due the Sisters in the hospital, who, through long and faithful service, have become past-masters in the art of nursing. Many of them have acquired a remarkable insight into the diagnosis of diseases as well as of postoperative complications.

The chief of the clinic is a graduate of the University of Pennsylvania, class of 1878. Taking up the study of anatomy, he soon became quiz master and then demonstrator of anatomy and lecturer on surgical anatomy, and later assistant professor of applied anatomy at his alma mater. Stimulated by such masters as Agnew and Ashhurst, he made rapid progress, and was soon appointed to the surgical staff of the German, the Philadelphia, St. Mary's, and St. Agnes's Hospitals, and to the chair of surgery at the Philadelphia Polyclinic. In 1896, having been appointed surgeon-in-chief to the German Hospital, the pressure of work compelled him to resign from these various appointments, to devote himself exclusively to this hospital. In 1911 he was called to the chair of the practice of surgery at the University of Pennsylvania. In 1908 Villanova College conferred upon him the degree of Doctor of Laws, and in 1912 Franklin

and Marshall College the degree of Doctor of Sciences. It is a remarkable tribute that the John B. Deaver Surgical Society flourished during its patron's 15 years' absence from the University of Pennsylvania.

Upon the appearance of Fitz's epoch-making paper, Dr. Deaver became deeply interested in appendicitis, and his first publication on this subject was an address delivered in 1891 before the John Ashhurst, Jr., Surgical Society of the University of Pennsylvania, entitled: "The Treatment of Inflammation in the Right Iliac Fossa from a Surgical Standpoint" (*Univ. Med. Mag.*, 1891-92, vol. 4). In 1896 appeared the first edition of his work on appendicitis, the fourth edition having been published last year (1913). Between 1899 and 1903 appeared the three monumental volumes on "Surgical Anatomy." In 1905 the book on the "Prostate," by Deaver and Ashhurst, was published, and later (1909 and 1914) the two volumes on "Diseases of the Upper Abdomen," by the same authors. The number of his journal articles is now well over a hundred.

The increase in the number of operations at the German Hospital has been remarkable. In 1885, when Dr. Deaver was appointed to its surgical staff, there were three surgeons, and the total number of operations was 435, with 28 deaths. Twenty years later, in 1905, there were 1595 operations, with 94 deaths. Here are the figures from 1909 to 1913, inclusive:

Year.	Number of operations.	Deaths.
1909	2080	79
1910	2132	73
1911	2451	94
1912	2315	78
1913	2544	75

These figures show not only a progressive increase in the number of operations, but also, what is even more remarkable, a progressive decrease in the number of deaths. In the first six months of 1914 there were 1500 operations performed. The total for these five years is 11,522 operations with 399 deaths—less than 3 per cent. These cases range through nearly the whole gamut of abdominal surgery, and to these is added a good variety of general surgery. The reporter has selected from this list the most interesting cases, with special reference to illustrating the various lesions to which each organ is liable. Let the reader, then, imagine that he is attend-

ing a very long clinic. The cases are presented in logical sequence from the head to the termination of the great excretory tracts.

CYST OF BRAIN; JACKSONIAN EPILEPSY; CRANIOTOMY—ABLATION OF CYST; RECOVERY

CASE I.—Male, 18, clerk, complained of epileptiform attacks.

At the age of 10 fell off wagon and horse stepped on skull, causing a depressed fracture in the *right* temporal region. Trephined and fragments removed. Abscess followed: incised and drained. At age of 13 (well in the intervening three years) began monthly attacks of numbness involving the *left* tongue, arm, and leg, and unconsciousness, but without convulsions.

Eighteen months ago clonic convulsions, ushered in by numbness on left side, were added to these attacks. These convulsive attacks have increased in number and severity in the last few months, and now come on every week. Each attack is followed by short coma. Between attacks is perfectly well and mentally alert.

Head shows a depression in right temporal region, and skiagram reveals an old depressed fracture with removal of bone and an inflammatory thickening of underlying structures. Right pupil smaller. Tongue flabby and coated. Reflexes and sensation normal.

At operation a horseshoe incision around the site of the old scar and skin was made, a fascia-muscle flap turned down, and a small cyst the size of a walnut found causing pressure on brain. This was excised and the wound drained. The symptoms gradually abated, and on discharge had entirely disappeared.

In the surgery of the cranium Dr. Deaver has always maintained a conservative attitude, not expecting much from extensive operative procedures. He prefers to treat fractures of the base by a *laissez faire* and watchful waiting policy, and has many recoveries (Deaver: "Operative Treatment of Head Injuries," *Annals of Surgery*, xiii, 434; also, "Additional Case of Tumor of the Brain, Localized Clinically and by the Röntgen Rays," *Phila. Med. Jour.*, 1902, vol. 10, and "Trephining for Extra-Dural Hemorrhage," *Jour. Nerv. and Ment. Dis.*, 1890, vol. 17).

FISTULA, SALIVARY (PAROTID); EXCISION OF PAROTID GLAND; RECOVERY. ANKYLOSIS, TEMPOROMANDIBULAR JOINT; RESECTION

CASE II.—Male, 67, laborer, complained of discharge from old wound on right side of face.

Four years ago a tumor appeared on the right side of the face, enlarged fairly rapidly, and caused sharp pain. When the size of a silver dollar and protruding, this was removed by paste applied by a charlatan. Since then an almost continuous discharge of saliva, increased by eating. Is unable to chew, and can open mouth but slightly, there seeming to be a catch in the mandibular joint. The right eye waters constantly; it does not close. On the right side of the face, midway between tragus and external canthus, is a sinus surrounded by granulations which discharge pus. The sinus discharges watery fluid (saliva), and a scar covers the whole of the right side of the face. A part of zygoma seems to be gone. Limited motion of jaw. Right side of neck shows scar of old injury.

At operation a vertical incision was made from above and in front of ear to middle of neck anterior to sternomastoid below. External carotid artery exposed and ligated. Dissection extended, and at angle of jaw parotid gland was exposed and removed entire. Temporomandibular joint on same side exposed, and condyle resected. Closure. After operation passive motion of jaw was secured by a mouth-gag.

Pathologic examination of the condyle shows slight rarefaction. Parotid measures 5 x 2.5 x 2.5 Cm., is partly opened, injected, and firm. Section surface is pale and dense. Microscope reveals atrophy of parotid and rarefaction of bone.

The original cause of this patient's malady was probably a mixed tumor of parotid salivary gland. Its uncontrolled removal by the blindly acting paste was responsible for destruction of the joint and of part of the zygoma. Correlating the constant epiphora and the imperfect closure of the right eye with the history, it follows that in attacking the zygoma the paste destroyed many of the temporal branches of the facial nerve, thereby relaxing the orbicular muscle and permitting the lacrimal punctum to fall away from the globe, the passage of the tears being no longer aided by the suction action effected by the muscle in the process of winking. The benign condition of the gland permitted removal while sparing the facial nerve. While it must be admitted that the paste destroyed the tumor, yet the cure was worse than the disease, since fistulæ of the gland itself are notoriously difficult to deal with, the loss of the power of mastication lowered the patient's nutrition, and an unsightly scar remained. Voltaire was right in saying that quackery started when the first swindler discovered the first fool.

TUBERCULOSIS OF PAROTID GLAND; INCISION AND DRAINAGE; RECOVERY

CASE III.—Female, 15, student, complained of sinus in front of left ear.

Two years ago had been operated upon elsewhere for bilateral cervical lymphadenitis. This was followed by swelling at upper portion of left parotid salivary gland, gradual breaking down of superficial tissues, and formation of a sinus. After discharging for a time, this healed with medical treatment, only to reopen.

At operation an elliptical incision in front of the left ear over the upper portion of the parotid was made, and the necrotic portion of the gland excised.

Pathologic examination revealed a torn shred of tissue the size of a bean, and microscope showed tuberculosis of the parotid salivary gland.

The infection of the salivary gland was doubtless secondary to that of the lymph-nodes that lie beneath the parotid fascia, because other cervical lymph-nodes had been involved previously, and also because the caseation was well localized and superficial. Had the infection travelled up through the duct of Stensen the deeper portion

of the gland would have been involved, and had it been hæmatogenous the entire gland would have been implicated. Tuberculosis of the glandular substance of the parotid gland is rare, and it cannot be differentiated clinically from tuberculosis of the lymph-nodes over the parotid.

CARCINOMA OF PAROTID GLAND; EXCISION OF GLAND; RECOVERY

CASE IV.—Male, 62, farmer, swelling below left ear.

Fifteen months ago noticed a small swelling beneath lobe of left ear, its central point raising lobule directly upward. This has grown, and causes an inconstant, dull pain. Since six weeks the pain has radiated up along the temple, and there is slight pain on opening the mouth.

Patient is large, plethoric, and obese. The tumor is indurated, movable, and tender, and has a diffuse margin. Examination of oral cavity shows edema at articulation of mandible. No enlarged lymph-nodes.

At operation, incision ran along anterior margin of left sternomastoid from middle of neck up over angle of jaw to point opposite external acoustic meatus, and one inch distant. Muscle retracted. Skin-flap retracted forward, and cervical fascia incised, exposing internal jugular vein and common carotid artery. Posterior belly of digastric muscle exposed and several enlarged lymph-nodes removed from submaxillary triangle. Hypoglossal and descendens noni nerves and external and internal carotid arteries exposed; external carotid surrounded by ligature, which was left untied.

Dissection of parotid begun anteriorly with exposure of Stensen's duct, which was ligated and cut. Gland then dissected inward and upward, incised in middle, and trunk of facial nerve followed to stylomastoid foramen. On turning the tumor upward the temporal vein was ligated and cut, and because of free bleeding the loose ligature around the external carotid was tied. The tumor completely surrounded the facial nerve. It was freed on all sides except at the attachment of the nerve, which was cut above and below the tumor and the latter removed. Nerve-ends approximated with chromic gut (Deaver: "Operative Treatment of Some Injuries and Diseases of the Nerves," *Med. News*, 1891, vol. 59).

Pathologic specimen shows nodules that infiltrate surrounding tissue, and whose cut section is grayish-white, with a few hemorrhagic areas. Microscope reveals carcinoma.

After operation there was partial facial palsy, the lower muscles being exempt.

It may be noted that the tumor began in the posterior process of the gland, for the patient first noticed its centre pushing the lobule upward and forward. This is not uncommon in cancer. Carcinoma is more frequent than sarcoma of the parotid. This gland is at times affected by scirrhus, just as the breast, in which condition the skin is puckered rather than swollen. It is manifested by early radiating pains, especially toward the head, and paralysis. In this case the pain radiated along the course of the auriculotemporal nerve. Had

the tumor been inoperable the pain could have been relieved by alcoholic injection of this nerve.

BRANCHIAL CYST; ABLATION; RECOVERY

CASE V.—Female, 48, first noticed a year ago in the front of the neck a pea-sized tumor, which began to enlarge six months ago, and became painful two months ago.

On the right side of the neck is a semi-fluctuating cystic tumor the size of an olive. It is slightly painful, but is not adherent to the skin.

At operation an incision two inches long was made over the cyst. The subcutaneous tissue was dissected free, and the cyst ablated. Closure.

Microscopically the cyst is enclosed in a fibrocystic envelope continuous externally with muscle and salivary tissue. It is the seat of a small amount of round-cell infiltration, and is limited internally by a cavity that is lined with low cylindrical or cuboidal epithelium. Diagnosis, congenital cyst.

This relic of the remote past before man had assumed the terrestrial habit is of significance in a person of this age in that, like other vestigial structures, it is liable to malignant degeneration, and into that form of cancer termed *branchiogenous*.

ABSCESS OF THYROID GLAND; INCISION AND DRAINAGE; RECOVERY

CASE VI.—Male, 35, complained of pain and swelling of neck. Two weeks ago had some pain in right side of neck. Five days ago noticed a swelling about size of egg in suprasternal notch. It was not painful unless he moved his head.

There is a firm, slightly movable, and tender tumor in the suprasternal notch, which moves on swallowing. As the incision opened the deep fascia, purulent, ropy, odorless fluid was evacuated.

Culture was sterile and Wassermann negative. There were 12,300 leucocytes.

Abscess of the parotid gland is rare. If unrelieved the pus tends to gravitate beneath the pretracheal layer of deep cervical fascia into the mediastinum.

THYROID BURSITIS; EXCISION; RECOVERY

CASE VII.—Female, 39, complained of swelling in neck.

Eight years ago first noticed a lump the size of a pea in the midline. Since one month this has grown more rapidly. It is painless, the only discomfort being on swallowing, when the patient feels "something knock against something else."

Over thyroid cartilage is a small, soft, elastic, painless swelling the size of a chestnut, which is fairly movable over the cartilage.

At operation a horizontal incision was made in a skin-crease, the muscles were cut in this plane and the bursa exposed. It was dissected free and removed entire. Closure.

There is another cyst that is met with at a slightly higher level, and is due to enlargement of the subhyoid bursa that is present between the posterior surface of the body of the hyoid bone and the anterior surface of the thyrohyoid membrane.

ANEURISM OF SUPERIOR THYROID ARTERY; EXCISION; RECOVERY

CASE VIII.—Male, 55, policeman, noticed about three years ago a small lump in the lower part of the neck on the right side. This gradually enlarged, and six months ago ulcerated. About one week ago he had a severe hemorrhage from it. The day before admission there was another severe hemorrhage, and on admission he was very weak from loss of blood.

On the right side of neck, extending from above cricoid to just above clavicle, there is a soft, fluctuating mass, regular in outline, and presenting at its lower part a small, ulcerating surface with one bleeding point.

At operation a vertical incision was made over the mass, the muscles separated, and the sternomastoid divided and retracted. Mass freed, isolated, and dissected out. Muscles apposed.

Pathologically, specimen consists of an aneurismal sac and overlying skin, 16 x 5 Cm. Skin surface shows an area of ulceration 4 x 3.5 Cm., in which is a perforation one square centimetre in size. Sac is 4 Mm. thick, and contains strands of organized fibrous tissue. There was a large hemorrhagic extravasation into the thyroid tissue.

The bifurcation of the common carotid artery, which is just below the origin of the superior thyroid, is a classical site of aneurism because of the slight dilatation normally present, the superficial and unsupported condition of the vessel, and the increased resistance in the blood current at that point. There may have been a high division of the common carotid, which would bring the superior thyroid near enough to its bifurcation to appropriate the aneurism. Aneurism of the branches of the external carotid is usually traumatic in origin, and the usual treatment is by ligation of the trunk itself.

It may be stated here that Dr. Deaver practised ligation of the superior thyroid artery in certain cases of hyperthyroidism associated with exophthalmic goitre five times in 1910, but has discontinued the operation.

COLLOID GOITRE; PARTIAL THYROIDECTOMY; RECOVERY

CASE IX.—Male, 61, carpenter, complained of swelling of neck (Fig. 4).

Since childhood has had a small goitre that only in the past seven years has increased perceptibly. In the last year or two it has grown rapidly, until now it is of huge size. Has had no pain, but occasionally respirations are embarrassed if he lies on the left side. Pressure on goitre produces slight nausea.

There is a large, soft, nodular swelling on both sides of neck, apparently connected with thyroid. The mass has three lobes, is encapsulated and freely movable. The lobe on the right is the largest. No pulsations are felt. Blood count: Hæmoglobin, 82; red blood-corpuscles, 4,860,000; white blood-corpuscles, 5050.

At operation, with a pillow beneath the neck and iodine preparation, a horse-collar incision encircling the lower circumference of the goitre was made. The skin and the superficial fascia were incised and the flap dissected upward, revealing the greatly distended anterior jugular veins. These were clamped inferiorly, so that when cut above no air would be sucked in. They were then clamped and cut higher up. The anterior layer of the deep cervical fascia was now incised,

and the infrahyoid and the sternomastoid muscles on the right side were retracted laterally, thus releasing the goitre, which sprang forth elastically through the wound. The capsule of the thyroid gland was incised laterally, and the posterior portion pushed backward. The goitre was pressed forward toward the surface of the neck, and the upper pole of the thyroid approached. Here the superior thyroid vessels were ligated. The pedicle of the goitre was transfixated and ligated and the goitre removed. The pedicle was phenolized. The same procedure was carried out on the left side, except that a portion of this lobe equivalent in size to an English walnut was allowed to remain. The stump of this left lobe was V-shaped, like the stump of the cervix after hysterectomy, and it was dealt with in the same manner, by oversewing the cut surfaces. The infrahyoid muscles, together with the cut edges of the anterior layer of the deep cervical fascia, were sutured. Skin edges approximated and drainage provided. There was much oozing, which was somewhat difficult to control.

Pathologic examination revealed cystic goitre, but no malignancy.

The superficial veins are more distended and often cause more bleeding than the deep vessels. The infrahyoid muscles are not divided, but retracted. The anterior portion of the capsule is usually insignificant. The pedicle is phenolized to prevent auto-intoxication from absorption of thyrotoxins from stump by raw surfaces of operative field. In the case of a goitre that involves both lobes, as here, a portion of the thyroid gland equivalent in size to an English walnut is always allowed to remain, prophylactic against hypothyroidism. Dr. Deaver has seen but one case of tetany, and this was controlled within a few days by calcium salts intravenously. He referred to a case of adenoma of the thyroid gland which was scheduled for operation, but the spleen was found much enlarged. Blood count: Hæmoglobin, 86; red blood-corpuscles, 3,000,000; white blood-corpuscles, 3000. Diagnosis, splenic anæmia. As the adenoma was not causing urgent symptoms, it was decided to postpone operation in order to study the patient with a view to performing splenectomy.

EXOPHTHALMIC GOITRE; PARTIAL THYROIDECTOMY; RECOVERY

CASE X.—Female, 36, complained of swelling in neck.

One year ago noticed swelling in right side of neck. This has extended anteriorly and become steadily larger. Is very nervous, and has sensation of tightness in head and eyes. Menses since six months scanty and irregular. Bowels move twenty times a day. For the eight days previous to operation pulse ranged between 100 and 130.

Patient is nervous. Eyes show marked exophthalmos and nystagmus.

At operation the right lobe was removed according to technic in previous case.

Pathologic examination revealed exophthalmic goitre.

During the past five years there were 122 patients operated upon for goitre, of which 42 were exophthalmic. There was a mortality

FIG. 4.



Huge colloid goitre. (See Case IX.)

FIG. 5.



Colloid goitre, right lobe. (See Case IX.)

of five cases, of which four were of the latter variety. Dr. Deaver's contributions to this subject include a paper on "Thyroidectomy" (*Amer. Lancet*, 1891, n.s., vol. 15), "Surgical Treatment of Exophthalmic Goitre" (*Annals of Surgery*, xxxviii, 202), "Use of X-ray in Goitre" (*Ibid.*, xlix, 579), and one on "Exophthalmic Goitre" (*Southern Med. Jour.*, 1901, 28-33). In the last the technic of the operation is given in full, and the most important factors for success are summarized as follows:

1. Selection of cases and choice of time for operation.
2. Careful anæsthesia, preference being for ether in absence of definite contra-indications.
3. Avoidance of mental excitement—"stealing" the patient from bed.
4. Quick, skilful operation.
5. Avoidance of injury to inferior laryngeal nerve and to parathyroid glands by preservation of posterior capsule and of parathyroid arteries.
6. Adequate drainage of wound.

CARCINOMA OF THYROID; PARTIAL THYROIDECTOMY; RECOVERY

CASE XI.—Female, 43, complained of swelling in neck.

Six years ago noticed swelling on right side of neck, gradually enlarging.

Four years ago, when growth was the size of a lemon, was operated upon in another hospital. One year after this operation the swelling returned, gradually reaching its present size. Occasionally it interferes with respiration and speech, but not with swallowing. There are no nervous symptoms.

There is a thyroidectomy scar on the right side. Beneath this is a roughly square thyroid tumor, semicystic and firm in spots, and moderately movable. No pulsation or areas of induration. Blood count: Hæmoglobin, 96; red blood-corpuscles, 3,900,000; white blood-corpuscles, 4850.

At operation the right lobe was removed with the usual technic.

Pathologically, half the tumor is firm, white, and glistening, and the other half necrotic, soft, and pulpy. There is no definite architecture. Microscope reveals carcinoma.

When carcinoma of the thyroid can be diagnosed clinically, operation is apt to be futile.

MYXEDEMA; THYROID EXTRACT; IMPROVEMENT

CASE XII.—Female, 40, complained of weakness and obesity, insidious in onset.

Four years ago fell down back steps, and onset of trouble coincides with this.

Slowly began to fatten, and has gained tremendously during this illness. Has developed a waddling gait. Skin has been thickening and is very dry; it desquamates at times, about once a month. Mouth constantly dry, and drinks

much water. Amount of urine is not proportionally high, and is light in color. Has excessive appetite, which is not satisfied by eating. Is obstinately constipated. Sleeps well and is drowsy most of day. Marked mental confusion, and mental activity is distinctly lessened. Headache and occasionally nausea. Constant chilly sensations and is chilly even when sitting by a hot stove.

No familial history of goitres or cretinism.

Well nourished, well developed, with excessive panniculus adiposus. Hair coarse and easily plucked from scalp. Thyroid lobes seem small and hard. Skin dry, and has tendency to form fine scales, which are very shiny. Excessive thickening of subcutaneous tissue on cheeks, neck, abdomen, and over scapulae. It is firm and does not pit on pressure.

After administration of thyroid extract tremor of fingers disappeared in three days. Felt better and ate less hastily; less nervousness; less chilliness; not so drowsy during day.

Recent clinical researches show that many obscure and often isolated symptoms are to be attributed to hypothyroidism, so that the entire subject is becoming of more importance day by day.

DIVERTICULUM OF OESOPHAGUS; REMOVAL; RECOVERY

CASE XIII.—Physician, 53, complained of dysphagia, pressure in throat, and then a desire to regurgitate food.

Ten years ago coughed a good deal while in recumbent position, and believes this was onset of trouble. Later, dysphagia, becoming worse; liquid food gave more trouble than solid from the onset.

Since two years food has been regurgitated every day after each meal, and often when laughing at meal times. Has lost twenty pounds since four years.

At present about half the food passes, and he is eating more than the ordinary amount. Has been on careful, nutritious diet. Blood count: Hæmoglobin, 85; red blood-corpuscles, 4,990,000; white blood-corpuscles, 7850.

At operation an angular incision was made along sternomastoid (six inches) and clavicle (four inches). Sternomastoid was freed from surrounding structures and its anterior portion severed just below middle. Sternohyoid and sternothyroid muscles also retracted and divided. Inferior thyroid vein ligated and cut.

Dissecting deeply, oesophagus was made prominent, and diverticulum located, delivered, and opened, care being taken not to infect surrounding tissues, which were well protected with gauze. After opening diverticulum a piece of gauze was inserted for protection, and further dissection made for greater exposure. Opening in diverticulum enlarged and entire sac removed. Oesophagus sutured at neck of sac first with double chromic gut, including all coats, and then with the same for cervical fascia over oesophagus. Divided muscles sutured with iodine gut. Counter-puncture made at most dependent portion, and in it a piece of rubber dam was placed for drainage. Closure.

After operation he was not allowed any water, nor to swallow involuntarily, and therefore was kept under opiates. Three days later was able to swallow crushed ice, then water. Opiates stopped. Ten days later incision was in splendid condition. The specimen measured 12 x 4.5 Cm. Microscope showed chronic interstitial inflammation with thickening.

In the diagnosis of this condition, if one side of the neck fills up somewhat during swallowing; if sound is at one time arrested at a short distance, whereas at another time it passes easily; if neck becomes inflated on swallowing and this swollen portion can be emptied on pressure, the diagnosis of diverticulum is confirmed, and bismuth-skiagram is superfluous.

According to Treves, hernial diverticula of the mucous membrane occasionally occur at the junction of the œsophagus and pharynx. They are usually named *pharyngeal pouches*, and protrude between the lower border of the inferior constrictor and commencement of the œsophageal musculature, opposite the cricoid cartilage. Since the pouch lies against the spine, it necessarily compresses the commencement of the œsophagus when it becomes filled with food.

STRICTURE OF ŒSOPHAGUS; DILATATION; RECOVERY

CASE XIV.—Farmer, 49, complained of inability to swallow solid foods since five months.

This has gradually become worse. Has lost 25 pounds. General health fair. Has enlargement of cervical lymph-nodes.

Bougie located two strictures, one opposite the upper border of the sternum, the other at the cardia. Bismuth-skiagram showed evidence of slight obstruction at lower end of œsophagus.

Blood count: Hæmoglobin, 80; red blood-corpuscles, 5,000,000; white blood-corpuscles, 11,900.

Bougies were passed every third day, gradually dilating strictures.

On discharge was improved, and advised to return for further treatment.

The patient's history was negative for venereal disease and tuberculosis. The age of the patient, the short duration of the malady, the enlargement of the cervical lymph-nodes, and, above all, the *absence of the history of swallowing a caustic*, speak for carcinoma, although it is patent that a positive diagnosis of malignancy could not be made.

Literature: "Surgery of the Œsophagus," in Warren and Gould's "International Text-Book of Surgery," 1900, vol. 2, pp. 166-185; "Fishbone in Œsophagus" (*Annals of Surg.*, xxii, 110; "Artificial Teeth in Œsophagus" (*Ibid.*, 111).

VARICES OF ŒSOPHAGUS; EXPLORATORY LAPAROTOMY; UNIMPROVED

CASE XV.—Male, 35 complained of repeated attacks of hæmatemesis.

Since ten years has had much gas in stomach, indigestion, and severe and weakening attacks of vomiting. Occasional hunger-pains, relieved by taking food. Never vomited blood before.

Four years ago, without warning, spat up a mouthful of bright red blood, and this was soon followed by a copious hæmatemesis.

Two years ago had another profuse hæmatemesis and also melæna.

One year ago had third attack of hæmatemesis, this time preceded by nausea and syncope. A few months later the fourth attack occurred.

Two months ago had the most severe attack of hæmatemesis and melæna. Was very sick, and it took longer to recuperate.

At present feels well, eats indiscriminately, and weight is normal.

Examination negative; liver is not enlarged. Blood count: Hæmoglobin, 56; red blood-corpuscles, 3,590,000.

Exploratory laparotomy showed no evidence of ulcer in stomach; the pylorus was patulous; there was no evidence of a lesion in gall-bladder; the duodenum and pancreas were normal.

This is an atypical case. Patients with varices due to cirrhosis of the liver usually suffer from hepatic indigestion, the distinguishing feature of which is a feeling of fulness in the upper abdomen, a feeling of constriction, which is constant but much increased after the ingestion of meat. This is not associated with pain simulating ulcer, with any evidence of gastric fermentation, with eructations of gas, or with any suggestion of alteration in the motility of the stomach (Deaver: "Gastric Hemorrhage," *Surg., Gynec., and Obstet.*, 1914, 294-299). To quote further from this article: "On the insistence of three medical colleagues, I recently operated upon a middle-aged man whose recital of this symptom, rather than the associated hæmatemesis, led me to disagree with their diagnosis of duodenal ulcer. This patient's history lacked the pain typical of ulceration; indeed, there were very few symptoms, except several attacks of hæmatemesis and the peculiar hepatic indigestion to which I have referred. Operation showed a cirrhotic liver—not ulcer. Ten days after the operation the patient succumbed to a fatal hæmatemesis. Autopsy revealed a perforated varicose ulcer of the lower end of the œsophagus. . . . The cirrhotic is a poor subject for surgery, even exploratory, and the futility of surgery in the emergency of hemorrhage from œsophageal varices is the cause of considerable chagrin to the surgeon who opens the abdomen for the cure of this variety of hemorrhage."

CARCINOMA OF ŒSOPHAGUS; GASTROSTOMY; IMPROVED

CASE XVI.—Harness maker, 64, complained of dysphagia.

Six weeks ago began to have distress after taking food, which has become worse.

Four weeks ago began to have pain and difficulty in swallowing. The pain subsided after food entered stomach.

At present it is only with the greatest effort that he can swallow liquids. There is no vomiting or regurgitating of food. He has lost about thirty pounds.

Abdomen full and soft except in epigastrium, where there is definite resistance. On deep palpation a mass is made out here which moves with respiration. No tenderness. A stomach-tube could not be passed on account of obstruction sixteen inches from teeth.

At operation an incision was made in median line above navel. Stomach delivered and opened by excising a small portion of its wall. Rubber catheter introduced and stitched into place with linen thread. Serous surfaces above and below tube sutured over tube for about two inches. Stomach replaced and sutured around tube to abdominal wall with iodine gut. Wound closed to tube with same material.

The operation of gastrostomy is applicable only to cancer of the cardiac orifice or of the œsophagus. It is seldom employed, and is indicated, as in this case, in patients who cannot swallow liquids. Mikulicz observed 46 patients with cancer of the cardia. Gastrostomy was done in 27 (58.7 per cent.) of these.

CHRONIC CYSTIC MASTITIS; AMPUTATION OF BREAST; RECOVERY

CASE XVII.—Female, 24, complained of tumor in right breast.

Four months ago, just before birth of last baby, both breasts became very large, and were massaged.

Since one year has had tumor in right breast and could not nurse baby.

Now there is milk in both breasts, even though baby died one month ago.

Right breast shows scar of incision above nipple, with hard, irregular, vaguely outlined tumor below scar, movable on muscles, adherent to scar. Left breast lactating.

At operation an elliptical incision five inches long was made around breast down to pectoralis major. Breast removed. Hæmostasis and closure.

Microscopic examination revealed chronic cystic mastitis. There was much epithelial hyperplasia, but no definite evidence of carcinoma.

An attempt at a cosmetic excision was made, but, owing to the great amount of cicatricial tissue within the breast, it was necessary to amputate. In dealing with mammary affections a cosmetic excision is not always safe. In this patient conditions were favorable for the development of mastitis carcinoma, first described by Volkmann in 1875, and now known as carcinoma mastitoides. This condition resembles inflammation, and is rapidly fatal.

TUBERCULOSIS OF BREAST; EXCISION; RECOVERY

CASE XVIII.—Female, 54, complained of ulcerating mass at upper outer quadrant of right breast.

One year ago a small lump developed in right breast. Patient squeezed this, and cheesy material was expressed from a small sinus.

One week ago, following a trauma, this small mass became inflamed, and soon broke down and ulcerated.

There is an open, ulcerating lesion in upper outer portion of right breast.

At operation an elliptical incision five inches long was made around breast down to pectoralis major. Mass removed. Hæmostasis, closure, drainage.

Pathologic specimen is a mass 1.5 x 2 Cm., hard. Cut surface shows smooth, white, laminated, fibrous tissue. In centre is an ulcerated perforation with skin adherent around periphery of ulceration. There is a definite wall and line of demarcation. Contents, cheesy. Microscope reveals tuberculosis of breast.

Primary tuberculosis of the breast is very rare, and especially so in a patient as old as this woman. This was the nodular variety of tuberculosis of the breast, and was of the secondary type (Deaver and Herman: "Tuberculosis of the Breast," *Am. J. Med. Sci.*, 1914, cxlvii, 157). It is curious to note that Virchow did not believe the breast was subject to tuberculosis. After the operation the patient was treated by tuberculin, together with hygienic and dietary measures.

NEVUS OF BREAST; EXCISION; RECOVERY

CASE XIX.—Female, 24, complains of tumor in right breast.

At operation incision exposed an encapsulated, pigmented tumor, which was excised. Closure.

Pathologic examination revealed a mass of inflamed and hemorrhagic tissue measuring 2.5 x 2 x 1.5 Cm. Microscopically, pigmented nevus.

This operation was performed five years ago. At the present time the judicious application of radium often cures nævi.

MYXOMA OF BREAST; EXCISION OF TUMOR; RECOVERY

CASE XX.—Female, 20, complained of tumor of right breast.

One year ago a small, painless swelling appeared in upper portion of right breast. This has slowly increased in size, but has continued painless.

Right breast shows a tumor about the size of a hen's egg in upper, inner quadrant. Skin freely movable over it.

At operation the tumor was removed through a small incision. Hæmostasis. Closure. Drainage.

Pathologic examination showed a pale, encapsulated, fibrous tumor the size of an English walnut. It was markedly indurated. Microscope revealed an intracanalicular myxoma.

This is a rare tumor of the breast, and occurs here in an unusually young patient, most of the cases reported having been met with in those of middle age or beyond. Like other benign tumors of the breast, it is apt to become malignant.

SARCOMA OF BREAST; EXCISION OF BREAST; RECOVERY

CASE XXI.—Female, 71, complained of tumor in left breast.

One year ago contused left breast and a short time later noticed a mass the size of a small marble. Growth has been rapid and there has been considerable pain. No loss of weight.

Tumor size of orange in left breast, which is freely movable on chest. Skin slightly adherent. One area red and soft. Nipple normal. No palpable lymph-nodes.

At operation the breast was amputated through an elliptical incision. Hemostasis and closure.

Pathologic examination showed an apparently encapsulated cystic growth of fleshy consistence, measuring $7.2 \times 6.5 \times 5.9$ Cm. It was nodular and slightly vascular. Microscope revealed sarcoma of breast.

Sarcoma is found in three per cent. of breast tumors, and half the cases are met with in the fifth decade of life. An interesting point in the etiology is the single contusion that preceded the appearance of the tumor. This is in keeping with Murphy's statement that sarcoma is more likely to follow a single severe contusion, and carcinoma a repetition of minor traumata (Deaver: "Sarcoma of the Breast," *Annals of Surg.*, xxxii, 725).

From 1909 to 1913, inclusive, there were six operations for sarcoma of breast. None died.

CARCINOMA OF BREAST; RADICAL OPERATION; RECOVERY

CASE XXII.—Female, 51, complained of tumor of left breast.

Three months ago noticed for the first time a lump at the lower part of the left breast. This has grown slightly. Occasional slight sticking pain in tumor. A small, hard mass occupies the lower inner quadrant of left breast. The skin is dimpled. No axillary lymph-nodes are palpable.

Blood count: Hemoglobin, 96; red blood-corpuscles, 4,910,000; white blood-corpuscles, 8900.

Skiagram requested for evidence of mediastinal involvement was negative.

Operation.—With the arm held at right angles the incision begins near the ensiform, separates to enclose the breast in an oval, and terminates at the insertion of the pectoralis major. The upper pole of the oval, which consists of skin, the superficial fascia and the deep fascia, is elevated as the first step in the plan of working from above and without downward and inward, thus securing axillary hæmostasis early. The pectoralis major is exposed near its insertion, and the knife plunged into the groove between its clavicular and its sternal heads, separating the latter. The sternal head is clamped close to its insertion and severed proximal to the clamp. The distal portion is later ligated, so as to prevent bleeding from the stump. The clavicular head is cut from its origin, to afford better exposure of apex of axilla. The pectoralis major, together with the underlying anterior layer of the clavipectoral fascia, is now lifted up, dragging with it the pectoral branches of the acromiothoracic axis artery and vein, the external anterior

thoracic nerve, and the perforating branches of the internal anterior thoracic nerve. The vessels are clamped and divided. As the nerves are divided the muscle contracts visibly. The pectoralis minor muscle, now exposed, is clamped and divided near its origin. The pectoralis minor, together with the underlying posterior layer of the clavipectoral fascia, is lifted up, the pectoral branches of the acromiothoracic vessels which supply it and also the long thoracic vessels are clamped and cut, and the internal anterior thoracic nerve divided. The subclavius muscle is removed. The neurovascular bundle in the axilla is now exposed. The external skin-flap is now reflected outward and backward until the latissimus dorsi muscle is exposed. Working toward the chest-wall, the subscapular artery and vein are first encountered and are clamped and cut close to their axillary trunks. The long subscapular nerve is isolated, and its integrity demonstrated by applying the excitator, whereupon the latissimus dorsi muscle contracts visibly, approximating the arm to the chest. Working along the same plane and in the same direction, the external respiratory nerve of Bell is met with, is freed, and its continuity shown in similar manner, the lower angle of the scapula being rotated outward and forward. An artery is encountered, clamped and cut: it is probably the alar thoracic. The areolar fatty tissue of the axilla, together with the enlarged lymph-nodes, is dissected free and thrown downward and inward with the mass to be removed. The lymph-nodes are found in three situations: along the axillary vessels, along the anterior wall, and along the posterior wall of the axilla. The lymphatics from the breast also drain into the supraclavicular lymph-nodes, into the spinal canal through the posterior portions of the intercostal spaces, into the anterior mediastinum through the anterior portions of the intercostal spaces, and into the liver *via* sheath of the rectus abdominis muscle and round ligament. The axilla having been cleaned out, the mass composed of skin, breast, fat, fascias, muscles, and lymph-nodes is freed toward the ensiform. In separating the pectoralis major from its sternal origin bleeding is encountered from the perforating cutaneous branches of the intercostal and internal mammary arteries: these, of course, have not been secured in the axilla, but otherwise the operative field is bloodless. A hæmostat is carefully applied to each bleeding point. The lateral cutaneous branches of the intercostal nerves are severed. The anterior sheath of the rectus abdominis muscle is removed in its upper portion, and for reasons that have been made plain. The mass is now removed. All vessels are ligated with catgut, and the hæmostats removed. It is found that the skin margins cannot be approximated. Both flaps are therefore undermined until the edges contact without undue tension. It has been necessary in certain cases to undermine the internal flap to such an extent that when finally sutured to the external the other breast rested in the midline of the body. The edges were apposed and secured by interrupted stitches of silkworm gut and of catgut. Drainage was established by a rubber tube, which emerged from a stab wound in the axillary skin. Dry dressing.

During the operation, examination of a frozen section by the pathologist revealed adenocarcinoma in the breast and in the lymph-nodes.

Early in the clinical course of carcinoma it is a purely local disease, beginning with the malignant transformation of a scarred epithelial surface. It is when the first twinge of pain comes or the

lump is first noticed that surgical *treatment* offers an excellent chance of cure. When, however, the disease is running riot through the tissues, we are performing a surgical *operation* only if we interfere at all, and are not instituting surgical *treatment*.

The incision is planned so that, while keeping wide of the tissue that is infected with carcinoma, there will be enough skin left to bring the edges in contact. Halsted, of Baltimore, makes a wider sweep and resorts to skin grafting: it may be that fewer recurrences follow his method. The incision is, of course, kept out of the axilla.

The distal stumps of the pectoral muscles are stitched to the walls of the axilla by Murphy, so as to prevent undue pressure on the axillary vessels. We avoid this pressure by maintaining the arm at a right angle to the body after operation. By this simple method oedema is seldom met with.

The prognosis in this case is good because the patient came very early (three months) in the course of the disease for operation. While she sought surgical relief much earlier than the average patient, yet the prognosis would have been much better had she come even sooner. "At least twenty-five per cent. of patients with mammary carcinoma are referred to the surgeon with the disease hopelessly disseminated. The majority of the remaining cases have observable cancer, which, as a rule, means inoperability. . . . Improvement can only come through the medium of the family physician, and lay education. Until there is thorough understanding among doctors that every lump in the breast of every person, male or female, young or old, is a cancer in the making and should be immediately removed, we need not expect any improvement in the final operative results of mammary cancer" (*Penna. Med. J.*, Jan., 1914). Other articles: "Operative Treatment in Carcinoma of the Breast" (*Annals of Surg.*, xxvii, 113) and "Bone Metastases in Carcinoma of the Breast" (*Ibid.*, xlvii, 323).

From 1909 to 1913, inclusive, there were 163 operations for carcinoma of breast, with one death.

TUMOR OF SPINAL CORD; LAMINECTOMY; EXCISION OF TUMOR; RECOVERY

CASE XXIII.—Farmer, 42, complained of pain, paresthesia, and unsteadiness of legs.

Two years ago the trouble began with sharp pain in left hypochondrium and side, coming on usually at night and lasting two hours, and relieved by getting up and walking around. At first had an attack once a week, but, for the last six

weeks, every night. Pain is sharp and shooting, but does not radiate. It has been severe enough to require an anodyne. In the severest attacks the left lumbar muscles go into spasm and form a hard, prominent mass. Has "girdle sensation" in epigastrium. Appetite good; bowels constipated; normal weight, 180 pounds, and now weighs but 168.

Gait ataxic: stands with toes outward and feet spread wide apart. Romberg sign present. Muscular incoördination of lower extremities, but no loss of power. Above waist, pain, tactile and temperature sense, muscular power and coördination are normal. Below hips, complains of peculiar drawing sensation and tingling. No impairment of temperature sense. Tactile and pain sense are indefinite. Girdle sensation always present when pain begins.

Reflexes.—Pupillary, normal; bicipital, normal; patellar, markedly exaggerated; ankle clonus, absent; Babinski, present on right; achilles, exaggerated; cremasteric, absent on right, active on left; testicles are analgesic; abdominal, absent.

Heel to knee test imperfectly performed. Passive movement of toes not appreciated. No muscular atrophy. Lately has had a circular constriction around calves of both legs, but worse on right side.

Skiagram of spine negative. Cytodiagnosis of cerebrospinal fluid showed a few polymorpha, and small lymphocytes predominating. Smears from same fluid showed no organisms, and cultures were sterile.

At operation a longitudinal incision was made over the spinous processes from the sixth to the tenth thoracic vertebrae, and the spines were snipped through at their bases. The laminae of the corresponding vertebrae were cut through and the dura was exposed and then incised. The cerebrospinal fluid was under hypertension. A tumor the size of a cherry, soft but not cystic, and exerting considerable pressure upon the cord, was found and removed. Dura sutured and wound closed.

Pathologic examination showed a tumor apparently encapsulated. Microscope revealed a fibrocellular wall. In many places there was considerable cellular exudation, and in others endothelial proliferation, with here and there oedematous and myxomatous degeneration. Foci of hemorrhage were present.

Nineteen days after operation there was no pain, and patient had recovered considerable use of legs.

Forty-three days after operation examination showed that all movements of legs and feet were well performed. Resistance to passive motions good. Irritation of soles of feet causes slight flexing of toes.

Reflexes.—Ankle, slight both sides, more marked on right; knee, prompt both sides; cremaster, normal on left, slight on right; abdominal, slight on right, absent on left.

Muscles of leg are firm, but smaller than before operation. Bowels constipated, though action of sphincters is normal. Erections normal. Pain, muscular and tactile sense normal. Testicles sensitive. Recognizes direction of passive movement of feet and toes. Heel to knee test badly done. No pain. Can walk without crutches. Cannot stand by himself unless holding on to something.

This patient was operated upon four years ago, and it is one of those fortunate cases of spinal cord disease in which operation benefits

the patient. Since then great advances have been made in the surgery of the spinal cord. We are learning better now how to select our cases for operation, whether the trouble is due to trauma or disease. Spinal decompression is performed in inoperable tumors and in those that are operable and capable of self-extrusion. Cases of spinal cord tumors are being reported in which there is no manifestation of pain (Lloyd, J. H., and Deaver, J. B., "Case of Tumor of the Cervical Region of the Spine," *Amer. J. Med. Sci.*, 1888, vol. 96).

HERNIA, EPIGASTRIC; RADICAL CURE; HYDROCELE OF CORD; EXCISION; RECOVERY

CASE XXIV.—Carpenter, 61, complained of tender lump in midepigastrium and another in right side of scrotum.

Three months ago, while lifting heavy girder, was seized with pain across upper abdomen, and several weeks later a small swelling appeared in midline. This has become larger and tender, and is painful when patient bends forward.

Since childhood, following an injury, has had lump in right side of scrotum. Recently this has commenced to grow, but it presents no subjective symptoms.

A small, tender, irreducible swelling in midline two inches above navel. A hydrocele of right cord, size goose egg.

At operation a vertical incision made over the epigastric tumor exposed a hernial sac coming out between recti. Sac freed and opened, no contents. Transfixed, tied off, removed. Sheaths of recti overlapped by catgut sutures.

Vertical incision over right side of scrotum. Testicle and hydrocele delivered. Latter dissected from cord, and at point of adhesion to testicle tunica albuginea was incised. Hydrocele removed entire. Incision in tunica closed, and denuded area of cord oversewn. Testicle and cord replaced. Closure.

Epigastric hernia as a cause of obscure epigastric pain and vomiting is apt to be overlooked. In this condition an annular orifice is found in the linea alba between the ensiform and the navel, usually about midway. Through this orifice a pellet of preperitoneal fat usually protrudes, and at times the wall of the stomach is nipped. In connection with the hydrocele of the cord, a hydrocele of the canal of Nuck will be described later on.

DERMOID CYST AT UMBILICUS; EXCISION; RECOVERY

CASE XXV.—Brakeman, 29, complained of discharge from navel and sharp pain in lower right abdomen.

One month ago "strained" abdominal muscles while applying brake. Worked until six days later, when he went to bed for three days on account of pain. At that time a slight discharge from navel was noted. The soreness disappeared, but discharge continued, and he returned to work at end of third day. Noticed a red and swollen prominence at navel.

Two days ago he noticed sharp pain below to right of navel, which lasted two days. Feverish; no vomiting; bowels regular; slight discomfort urinating.

Since attack discharge has lessened, but tumor is more tender upon pressure. Has sensation of cord running down from navel. Leucocytes, 10,300.

At operation a vertical incision was made below navel down into muscles, and considerable pus was evacuated. Small tumor, resembling dermoid, was excised from navel.

Pathologic examination of the tumor revealed sebaceous material, hair and blood. No tubercle bacilli were found in the discharge, but culture disclosed *B. coli communis*.

Because of its embryologic significance the navel is a logical place for the appearance of dermoid, as of other, cysts. Tubulocysts of Bland-Sutton which here arise from the vitello-intestinal duct and the urachus may occur. A patent urachus may cause a urinary fistula at the navel, and a patent Meckel's diverticulum a fecal fistula.

HERNIA, UMBILICAL, STRANGULATED; RADICAL OPERATION; RECOVERY

CASE XXVI.—Female, 68, complained of pains in abdomen and vomiting.

Since fifteen years has had hernia at navel, which has been irreducible since eight years.

Since one year has had several attacks of cramps in hernia, but never vomited.

Evening before day of admission cramps began across epigastrium and in hernia, gradually becoming worse and followed in two hours by vomiting, which has persisted. Last bowel movement that morning. Enemata futile.

A lobulated, tympanitic, irreducible hernia at navel about size of large orange. Tender to firm pressure and bluish. Coils of bowel palpable; moderate peristalsis elsewhere.

At operation a transverse incision was made across lower portion of sac down to and through aponeurosis of external oblique. Neck of sac isolated and incised all around, opened, and a mass of ileum and transverse mesocolon released. Adhesions between bowel and wall of sac dissevered and ligated. Constriction at neck of sac divided. Circular constriction of ileum, which was pale, but not dark-bluish. Bowel replaced; redundant sac excised. Upper flap of aponeurosis overlapped upon lower by a mattress suture; free edge tacked down. Deep layer of superficial fascia sutured. Redundant skin and fat excised. Closure.

The abdominal wall is a part of human anatomy that is much neglected. In childhood more care should be taken with the stump of the umbilical cord, and infantile umbilical herniæ more carefully treated, and if strapping does not result in cure, as it usually does, radical operation should be performed, despite the age of the little patient. In boys, phimosis is a cause of increased intra-abdominal pressure that is often overlooked. During pregnancy a maternity belt should be worn, and the tone of the abdominal muscles maintained by judicious massage: this also diminishes the tendency to the formation of lineæ albicantes. Such care should also be taken after the

puerperium, and conditions that produce tympanites, and other sources of strain upon the abdominal walls, should be removed. Most of these patients are poor operative risks.

From 1909 to 1913, inclusive, there were 63 operations for umbilical hernia. Of these, ten were strangulated. There were five deaths.

HERNIA, INGUINAL, DIRECT; RADICAL OPERATION (FERGUSON); RECOVERY

CASE XXVII.—Shoemaker, 33, complained of rupture on left side of groin.

Since three years he has noticed a swelling in left inguinal region, which has gradually increased in size. Little trouble until recently. It becomes larger when doing heavy work. At times there is difficulty in reducing it. Has not worn a truss.

A large, complete, left inguinal hernia, which is reducible.

At operation the incision began near anterior superior iliac spine and passed downward and inward parallel with and three-quarters inch above Poupart's ligament, terminating just beyond external abdominal ring, exposing the spermatic cord as it emerged from the latter. The incision through the aponeurotic tendon of the external oblique skirted the upper portion of the external ring, terminating just above its internal pillar. By not opening into the ring the resistance it lends to a recurrence of hernia is preserved. The ilio-inguinal nerve, coursing upon the internal oblique muscle from the direction of the anterior superior iliac spine, was isolated and retracted toward the thigh. Trauma to this nerve is a source of postoperative pain. In operating under local infiltration anaesthesia the nerve may be blocked at this stage. The lower flap of the external oblique aponeurosis was freed until the shelving margin of Poupart's ligament was clearly revealed, and the upper flap was freed upward. On pushing the arching fibres of the internal oblique muscle upward with the handle of the scalpel the sac of the hernia was exposed and its direct course determined by its position internal to the deep epigastric vessels. The hernia was the size of a man's fist, and was covered by the thinned-out transversalis fascia and conjoined tendon. These two layers were incised and pushed back from the sac by gauze dissection. In approaching the neck of the sac the testicle, the vas deferens, and the spermatic vessels appeared on the side of the sac, and were cleared from it. In thus separating the vas deferens the unavoidable trauma is a potential cause of postoperative epididymitis. The sac was thickened and vascularized by elongated and dilated vessels. To control bleeding from these it was *transfixed* and ligated, instead of merely being ligated. The sac was empty, and it was shown that there were no adhesions of the abdominal contents to its neck. In the restoration of the inguinal canal the spermatic cord was *not* transplanted, because the greatly thinned-out conjoined tendon was not strong enough to form the new posterior wall. The tendon was therefore stitched to the shelving margin of Poupart's ligament over the cord, the divided edges of the external oblique aponeurosis were approximated, and the skin closed.

This patient was rather young to have such a large hernia. It is unusual for a direct hernia to descend so far into the scrotum.

HERNIA, INGUINAL, DIRECT (R.) AND INDIRECT (L.); RADICAL; RECOVERY

CASE XXVIII.—Waiter, 50, complained of bilateral rupture.

Since fifteen years has had a right-sided hernia; wore truss for short time.

Since few months has had pain in this side.

Since one year has noticed swelling in left inguinal region.

Has had no cough; no dyspepsia.

Right inguinal hernia is incomplete; left is smaller; both are reducible.

At operation, after exposing the internal oblique muscle, the handle of the scalpel was swept first under the conjoined tendon so as to expose the spermatic cord; secondly, farther out between the arching fibres of the internal oblique and transversalis muscles, just external to the spermatic cord, with a view to freeing the transversalis muscle fibres from the transversalis fascia, so that the latter can retract when the sac is removed. There was now revealed a mass of preperitoneal fat (lipoma of the inguinal canal), upon the removal of which the small sac of an incipient hernia was exposed. To the inner side of the sac the deep epigastric vessels were demonstrated, thus proving the indirect course of the hernia. The sac was opened and found empty. The underlying sigmoid was shown. After disposal of the sac the operation was finished with transplantation of the spermatic cord.

On the right side the sac was the size of a plum, and was empty. Its neck would admit the tip of the index. On drawing the ileum into the wound a diverticulum as large as the little finger was seen on its antimesenteric border, but it was deemed good surgery not to disturb it. The appendix was removed. The cord was transplanted in this case because the conjoined tendon was not spread over the sac, the latter emerging through the outer portion of Hesselbach's triangle, beyond the edge of the conjoined tendon, therefore being covered by transversalis fascia only, and no conjoined tendon.

The statistics of inguinal hernia for our five-year period from 1909 to 1913 are:

Year.	Inguinal.	Deaths.	Incarcerated.	Deaths.	Strangulated.	Deaths.
1909	107	0	3	0	5	0
1910	131	1	6	0	6	0
1911	153	3	2	0	7	2
1912	173	0	3	0	4	1
1913	177	0	4	0	5	1
Totals	741	4	18	0	27	4

The total number of inguinal hernias, therefore, is 786, and the total number of deaths is eight, a mortality of a fraction over one per cent. Among Dr. Deaver's published articles on this subject are: "Treatment of Gangrenous Hernia" (*Annals of Surg.*, xx, 189); "Case of Bilateral Operations for Strangulated Hernia" (*Ibid.*, xxiv, 63); "Radical Cure of Inguinal Hernia" (*Ibid.*, xxvii, 459); "Radical Cure of Hernia" (*Ibid.*, xxxi, 651).

HERNIA, FEMORAL, STRANGULATED; REPAIR; ENTEBO-ENTEROSTOMY; RECOVERY

CASE XXIX.—Male, 46, emergency operation, and no history was taken.

At operation a right inguinal incision was made over the tumor, and a strangulated femoral hernia exposed. Gimbernat's ligament, the site of constriction, was cut. Sac opened and contained free fluid. Ileum very much congested from a kink, and one area, the size of a dime, was dark blue. In the centre of this area was a small perforation one-eighth inch in diameter. Intestines distended except at site of constriction, which remained flat. Resection was followed by an end-to-end union, and this by a lateral anastomosis. Intestines returned with difficulty on account of small opening of femoral canal. To return them it was necessary to cut lower fibres of Poupert's ligament. These fibres were sutured with chromic gut. The sac was not closed: cigarette-drain placed in peritoneal cavity.

Pathologic examination of intestine showed early gangrene. It measured 5 x 1.5 Cm. Bacteriologic culture revealed *B. fecalis alkaligenes*.

Had the nature of the hernia been divined previous to operation it would have been better to have approached it by the inguinal route of Ruggi. It will be noted that the patient is a male, seeing that femoral hernia in this sex is notoriously unusual.

The statistics of femoral hernia for the five-year period are:

Year.	Femoral.	Deaths.	Incarcerated.	Deaths.	Strangulated.	Deaths.
1909	13	0	1	0	4	1
1910	9	0	0	0	3	0
1911	12	0	0	0	3	0
1912	15	0	2	0	4	1
1913	15	0	2	0	1	0
Totals	64	0	5	0	15	2

The total number of femoral hernias, therefore, is 84, and the total number of deaths is two, both strangulated, a mortality of a fraction over two per cent. Article: "Strangulation of Fimbriated Extremity of Fallopian Tube in Sac of Femoral Hernia" (*Annals of Surg.*, xl, 154).

GUNSHOT WOUND OF ABDOMEN; NO OPERATION; RECOVERY

CASE XXX.—Female, 24, recipient of bullet wound through left side of abdomen.

Bullet had entered abdomen just to left of navel, and had lodged subcutaneously, posterior to the crest of the left iliac bone, where it was detected by skiagram. Bullet easily extracted from muscles, and was neither crushed nor fragmented.

No signs of perforated viscus; no pain; no distention or rigidity; good peristalsis and other evidence of absence of general peritonitis.

Fifteen hundred units of antitetanic serum injected into right abdominal wall. No enema given for fear of damaging a possibly injured bowel.

Patient was neither shocked nor much exhausted after experience.

This proved to be a simple penetrating gunshot wound. Many times it is hard to distinguish this variety from a penetrating and perforating wound. Many patients whose abdomen has been penetrated by a bullet with a wound of entrance and one of emergence have been subjected to exploratory laparotomy, and no evidence of visceral injury discovered. As in this case such wounds give few or no symptoms. Again, many cases have been operated upon in which there were present no symptoms indicating the serious nature of the injury, for the reason that the patient was not bleeding, as the perforations were in the "bloodless" portion of the bowel (J. V. Brown). The safest course to pursue is "when in doubt, perform laparotomy." Article: "Indications and Nature of Treatment in Severe Abdominal Injuries, etc." (*Med. News*, 1895, vol. 66).

HÆMATOMA, GASTROCOLIC OMENTUM; INCISION AND DRAINAGE; RECOVERY

CASE XXXI.—Driver, 42, complained of pain across stomach.

Five months ago was kicked in epigastrium by horse, laid up in bed for a month, then went to work and back to bed again. Since then has been working a few days and going back to bed again.

After accident vomited several days and many times since, and often was nauseated. Has not been able to eat much except toast, eggs, and other light articles. Has lost ten pounds in five months. Bowels regular; no jaundice.

Since one week has had considerable cough, with pain across epigastrium.

Two nights previous to admission had a chill which lasted two hours.

A large, somewhat nodular mass size of grape-fruit in right hypochondrium, and extending to a hand's breadth below ribs in midclavicular line. No masses over stomach.

Skiagram revealed a definite shadow, ovoid in shape, 5 x 6 inches in size, extending downward from margin of liver toward navel, moving freely with liver, and evidently connected with it. Stomach shadow normal in outline and position.

Test breakfast showed free acidity of 8, total 19.

Blood count: Hemoglobin, 70; red blood-corpuscles, 4,630,000; white blood-corpuscles, 7100.

At operation, incision made through upper right rectus revealed a fluctuating mass in gastrocolic omentum. Trochar drained off dark, thick, yellow fluid, with disintegrated blood. One rubber tube, surrounded by four pieces of gauze, was placed in gastrocolic omentum. Wound closed about drainage.

Pathologic examination showed greenish-brown, alkaline fluid, 1010, negative for bile and its pigments, but large numbers of red blood-cells. Culture sterile.

Injuries akin to this are described in Deaver and Ashhurst's work on the "Surgery of the Upper Abdomen." First, there is the case recorded by Vatter of rupture of the right gastro-epiploic artery, due to the kick of a horse. Laparotomy was done on account of symptoms of internal hemorrhage. There was an insignificant tear in the margin of the liver. The artery was ligated and recovery ensued. The cause of the hemorrhage in Case XXXI was obscure because of the length of the time (five months) since the injury was received. The second case was that of Ziegler, whose patient had received an abdominal injury some weeks previously; he found a large hæmatoma in the anterior wall of the stomach; recovery was uneventful. This classifies as an interstitial rupture of the stomach, which may cause (1) hæmatoma, (2) cyst, (3) abscess. The first lesion is possibly the rupture of a vessel in the submucosa, and if small the hæmatoma may be gradually absorbed. If large, however, a cyst will form, and may become infected through the mucosa, so that an abscess results. Thus, Chutro, of Buenos Aires, records the case of a boy of nine years who received a kick from a horse in the epigastrium; nineteen days later an interstitial abscess in the posterior gastric wall was opened and drained; uneventful recovery ensued.

SUBPHRENIC ABSCESS; TRANSPIEURAL INCISION; RECOVERY

CASE XXXII.—Stock boy, 15, taken ill day before admission with abdominal pain, at first general, then localizing to right iliac fossa, and becoming intermittent. Vomited twice, and later took *cathartic*.

Slight rigidity of lower right rectus, with deep tenderness.

At operation an incision through this portion of the muscle evacuated cloudy fluid. Intestines were walled off with pads. Incision enlarged upward, and collection of pus found in subphrenic space. Appendix retrocecal, high up, and pointing upward; long, thin, acutely inflamed, gangrenous and perforated near tip. Removed by cautery and stump invaginated. Very copious drainage was placed above and below the liver, in the pelvis, and near the incision.

Pathologic examination revealed acute suppurative appendicitis, and *B. coli* was isolated from pus.

The symptoms did not subside entirely after operation, and the leucocytes continued up around 20,000.

At the second operation the tenth rib was resected in the posterior axillary line on the right side, and the subphrenic space opened into. Free drainage was provided.

Two months after first operation patient was discharged with a granulating wound and in good general condition.

The development of subphrenic abscess was favored by the high position of the appendix, and, furthermore, by its length and upward pointing. It was a fulminating case. The pus entered the right renal pouch and then the right posterior intraperitoneal subphrenic space, and, travelling around the free edge of the right lateral ligament of the liver, invaded the right anterior intraperitoneal subphrenic space. Appendicitis is the cause of about one-sixth of the cases of subphrenic abscess, and of these two-thirds are intraperitoneal.

The prognosis of subphrenic abscess is bad. Fortunately, the number of cases following appendicitis is diminishing, owing to the hurrying of patients afflicted with this malady to the operating table. Thus, in the first two years (1909 and 1910) of our five-year statistical period there were five cases, while in the remaining three years there were only two. It is the most frequently overlooked of all the complications of appendicitis.

THE LIVER AND BILIARY PASSAGES

RUPTURE OF LIVER; LAPAROTOMY AND PACKING; RECOVERY

CASE XXXIII.—Mechanic, 24, crushed by locomotive at Baldwin's Works.

About 3 o'clock on afternoon of admission was caught between two heavy objects, crushing lower part of right chest anteroposteriorly. Temperature, 98; pulse, 84; respiration, 28. Fracture of lower few ribs on right side. Impairment of percussion note in both flanks. Moderately tender over liver. Liver dullness not obliterated; no rigidity; peristalsis present; chest clear. Faint crackle occasionally over region of fracture. Diagnosis, fracture of ribs and probably rupture of liver; immediate operation advised.

Patient refused to be operated upon until arrival of family. Pulse gradually grew weaker and rapid, mucous membrane and skin blanching, and dull note in flanks rising. Catheterized urine was clear. Blood count: Hæmoglobin, 80; white blood-corpuscles, 23,700.

Operation by Dr. Ross at 7.30—four and one-half hours after accident. Pulse now very weak, 140. Incision through upper portion of right rectus. Blood was everywhere. Rupture in right lobe of liver posterior surface, three inches wide and of an equal depth, gaping widely and oozing considerably. Seven pieces of gauze were packed in layers into the rent. Clots sponged out hurriedly. Closure by through-and-through sutures. Received intravenous saline during operation, so that pulse was better at end of operation than before.

In the postoperative treatment intravenous saline and much morphine were given repeatedly. The last piece of gauze was removed on the sixth day.

This patient flirted with death and won. If operated upon within the first six hours the mortality is 39.5 per cent., while in the next six hours it is 50.4. At first the pulse was slower than one might

expect, but bradycardia has been observed after these injuries, just as it occurs in some cases of cholæmia, and is thought to be the result of the action of bile-acids. The diagnosis is often difficult, especially at first, but a history of injury in the hepatic region always should make one suspect rupture of the liver. The prognosis varies with the nature of the rupture and the promptness of operation. Thus, rupture of the hepatic tissue involving the capsule operated upon early, as in this case, offers a fairly good prognosis. In subcapsular or central rupture recovery may follow without operation, but an hepatic or subphrenic abscess is liable to develop. Therefore, while the immediate danger is from hemorrhage, the remote is from sepsis, although a few instances of embolism by pieces of hepatic tissue have been recorded. The treatment is immediate laparotomy with repair of the lesion. If the rent be accessible, the wound may be sutured with promise of a speedier convalescence; otherwise gauze packing is easier. It need not be pressed in very tightly, because the blood-pressure in the liver is quite low. The tampon was not entirely removed until the sixth day: this was to prevent secondary hemorrhage, which might occur up to that time. Omentoplasty, in which the omentum is stuffed into the liver wound or stitched to its borders, is an excellent method of choice in controlling hemorrhage from this organ ("Treatment of Abdominal Injuries with Intra-abdominal Hemorrhage," *Annals of Surg.*, xxi, 326; Deaver and Ashhurst: "Surgery of the Upper Abdomen").

ECHINOCOCCUS CYST OF LIVER; INCISION, EVACUATION, AND DRAINAGE; RECOVERY

CASE XXXIV.—Austrian butcher, 19, complained of indigestion.

Since five years has had attacks similar to present.

Four weeks ago seized suddenly with severe pain in epigastrium, radiating across upper abdomen and into back, and lasting several hours. Noticed epigastric swelling. Had one chill.

Two weeks ago had last attack. Pain of two hours' duration. Vomited after drinking. Has lost about 15 pounds in last two months.

Visible swelling about size of small orange in epigastrium, exceedingly tender, dull to percussion, moves slightly on respiration, and not differentiated from liver. On deep percussion a suggestive tympany is obtained. Upper dulness of liver at sixth rib; lower continuous with that of tumor.

During the five days between admission and operation complained continuously of severe pain in tumor, and required morphine. Tumor enlarged steadily, reaching to about 5 Cm. above navel, and slightly more to left than right. Leucocytes, 17,600.

At operation through an incision in the right rectus the left lobe of the

liver was low and its convexity boggy. Moderately dense adhesions bound it to surrounding tissues. In dissecting an adhesion the wall of an abscess in this lobe was ruptured and a thin stream of pus appeared. Attempts at aspiration being fruitless, after protecting the surrounding tissues with gauze pads, the small opening was enlarged by the finger, liberating a large quantity of pinkish-yellow, faintly odorous fluid containing many "white grapekin" cysts in a state of collapse. These varied in size from a small pea to a large bird's egg. About one pint of this mixture was evacuated, and a cavity fully as large as a man's fist found. This was curetted and drained, and the opening of the mother cyst walled off by gauze pads above and below edge of liver. Closure.

Nineteen days after operation the rubber tube came out, followed by the lining of the wall of the great cyst and numerous broken-down smaller cysts.

Five weeks after operation developed symptoms of ureteral calculus, and the next day passed *per urethram* an irregular, whitish, granular, moderately firm stone, the size of a large pin-head.

On discharge much bile and mucus were oozing through the sinus, but the abscess cavity was almost obliterated.

Pathologic examination revealed a multilocular hydatid cyst, with a large amount of blood, broken-down liver-cells and fat. Individual daughter cysts apparently contain the liver substance. Microscope showed hyaline degeneration of cyst wall. Culture from cyst contents sterile.

This cyst was favorable for operation by its accessibility and mildly infectious nature. The patient was fortunate in having just enough disturbance to denote the presence of the cyst and yet not sufficient infection to jeopardize his recovery. Although the cyst had been fairly latent for five years, during the last month it became active, and the chill was significant of beginning infection. The patient was also fortunate in escaping complications such as rupture of the cyst into an adjacent cavity or viscus. The case was suitable for the formalization prophylactic treatment of Quénu, but it is doubtful if a better result would have been obtained.

CASE XXXV.—Female, 52, complained of dull, aching pain in epigastrium, fever and sweating.

Operated upon two years previously: cholecystectomy; appendicectomy; salpingo-oophorectomy.

Relief for five months, when suddenly was seized with sharp pain in epigastrium and right hypochondrium with vomiting. Duration, ten minutes.

Since then has had many attacks of increasing intensity. During these was jaundiced, and had chills, fever, and sweats.

Has flatulency and distention, constipation, clay-colored stools, and dark urine.

Skin jaundiced and pasty. Tenderness at a point in epigastrium to right of midline. Scars of previous operations.

At operation through an upper right rectus incision adhesions between liver and omentum, and colon and liver were ligated and dissevered. Gall-bladder absent. Pancreatic lymphangitis present. Portal vein found to *right* of hepatic duct, greatly thickened, enlarged, and the site of pyelephlebitis: hypodermic needle withdrew dark, venous blood. Hepatic artery tortuous and to inner side of vein. Common duct to *inner side* of hepatic artery: thickened and patulous, bile withdrawn; one rubber tube sutured into it. On expressing liver reddish-brown bile, mixed with pus which indicated cholangitis, exuded. Right lobe of liver thickened and chronically inflamed. Drainage of adjacent fossae. Closure.

After operation prolonged drainage of common duct was maintained, and on discharge patient still wore the "T" tube, which now drained healthy bile.

The patient's chief disturbance was chronic catarrhal cholangitis with acute exacerbations. It is not unlikely that the pancreatic lymphangitis offended by causing pressure upon the common bile-duct. Prolonged drainage of the latter is indicated in both of these conditions, and these patients are often aware of the relief and comfort associated with prolonged wearing of the tube.

EMPYEMA OF GALL-BLADDER WITH PERFORATION; CHOLECYSTECTOMY; CHOLEDOCHOSTOMY; RECOVERY

CASE XXXVI.—Female, 52, complained of pain in right hypochondrium.

Since twenty-five years has suffered from indigestion, especially from bread and meat, epigastric pain and constipation.

Three weeks ago attack began with pain in gall-bladder region referred to scapula and back. Did not vomit. Chills and fever, but no jaundice.

Tender mass in right hypochondrium. Leucocytes, 8700.

At operation through upper right rectus incision there were adhesions between gall-bladder and omentum, and gall-bladder and colon; these were ligated and dissevered. Intestines walled off with gauze pads. Gall-bladder contained pus and showed a small perforation. Cystic duct and cystic artery ligated, gall-bladder removed, and fossa oversewn. Patency of common duct determined by probe. Common duct incised and "T" tube sutured into it. Glass tube placed in subhepatic space.

Culture of pus showed *B. coli communis*.

Had this patient been operated upon at an earlier period in the course of her disease she would have been spared many years of suffering, and the suppuration in the gall-bladder would have been prevented. The present attack, accompanied by chills and fever, indicated the lodgment of a virulent infection in a gall-bladder that had been the seat of a long-standing chronic cholecystitis. There were two ways for the pus to evacuate itself. The rarer is through the cystic duct. The more common is by perforating ulceration of the

gall-bladder walls. Nature anticipated such an event in this case by hemming the gall-bladder in with the omentum and colon, else more mischief would have resulted. Had operation been refused, the further course might have been a natural cholecystocolostomy, and the empyema would even have been converted into a hydrops with sterile or slightly infectious contents. Thus, hydrops may precede or follow empyema. The fate of this chronically diseased gall-bladder justifies the performance of cholecystectomy for chronic cholecystitis. At times the organ becomes extremely distended. Such a case was operated upon by Dr. G. G. Ross at the German Hospital. The distended gall-bladder, full of pus, reached to the brim of the pelvis.

ACUTE CHOLECYSTITIS; CHOLECYSTECTOMY; RECOVERY

CASE XXXVII.—Female, 63, complained of pain in right hypochondrium.

Sixteen years ago was confined to bed with severe pain in right hypochondrium. No jaundice. Then had chills, fever, and nausea, but no vomiting.

Since then has had chronic dyspepsia and constipation.

Two weeks ago the same old pain recurred. It was severe and cutting, and radiated about abdomen. It was accompanied by much gas and nausea, but no vomiting. No chills, fever, or jaundice. Blood count: Hemoglobin, 81; red blood-corpuscles, 3,970,000; white blood-corpuscles, 22,450.

Rigidity of upper right rectus and moderate tenderness below ninth right costal cartilage. Swelling barely detected below right costal margin.

At operation, with a sandbag under the lower thoracic spine, a curved incision was made, beginning just below the ensiform, following with slightly upward and outward convexity the costal margin, and then going straight down between the fibres of the rectus. Large gauze pads inserted to protect the viscera and keep them from protruding into the operative field. Liver dislocated downwards and then upwards over costal margin, thus bringing it partly out of incision, by seizing the margin with gauze, taking care not to crush the friable parenchyma. No adhesions to be cleared. Gall-bladder distended and lymph-nodes on lesser curvature of stomach enlarged. Gall-bladder and cystic duct freed. Cystic artery clamped and later ligated. Cystic duct clamped and cut distally. Gall-bladder dissected from its fossa from below upward, removed, and sent to laboratory for frozen section. Fossa obliterated at once by oversewing. Stump of cysticus dilated by forceps and entered by probe, which explored common duct and passed through ampulla of Vater and bile papilla into duodenum. Small rubber catheter placed into and secured to stump of cysticus. Rubber tube placed into subhepatic fossa. Gauze pads removed and counted. Instruments accounted for.

Pathologic report of frozen section showed acute cholecystitis upon a chronic process. Culture from contents of gall-bladder sterile.

This patient had a milder infection than the preceding case, since there were no chills and fever, and no adhesions were found at opera-

FIG. 6.



Empyema of gall-bladder, showing small perforation. (See Case XXXVI.)

FIG. 7.



Acute appendicitis of two days' duration, about to rupture. Note great distention proximally, and subserous cyst distally. (See Case LXVI.)

FIG. 8.



Microscopic appearance of carcinoma of appendix. 1. Nests of cancer cells. 2. Glands of Lieberkühn. 3. Lymphatic nodule. (See Case LXVI.)

tion. Theoretically, the leucocyte counts should have been reversed for the two patients. However, the lymphangitis and lymphadenitis in the lesser omentum might account for the difference. Care must be taken to secure the cystic artery, for it is a sharp spurter when cut. It is a branch of the hepatic, and is distributed to the gall-bladder and its fossa. Inflammatory œdema of the bile papilla may obstruct the passage of the probe, but not of the flow of bile. No operation upon the biliary tract is complete without exploration of the choledochus. If the cystic duct be tied off, care must be taken not to pull upon the common and hepatic ducts at their point of junction with the cystic, since this may lead to their being included in the ligature, an error which leaves the last state of the patient worse than the first. If not tied off, the small catheter in the stump of the cysticus is useful for drainage and to afford a means of flushing the choledochus as well as provide an additional avenue for enteroclysis. The abdomen should never be closed without drainage, lest the back pressure of the bile force the ligature on the cysticus. Here again is the advantage of having a tube in the latter. The distention of the gall-bladder and the omental lymphadenitis were both indications for the cholecystectomy ("Cholecystectomy," *Surg., Gynec. and Obstet.*, 1913, 667-673).

CHRONIC CHOLECYSTITIS; PANCREATIC LYMPHANGITIS; CHOLECYSTECTOMY; RECOVERY

CASE XXXVIII.—Female, 48, complained of pain in right hypochondrium.

Eleven years ago had a severe attack of biliary colic, and was deeply jaundiced.

Since six weeks has had pain in right hypochondrium. Beginning near mid-axillary line the pain rapidly spreads to right shoulder. It starts usually about 1 A.M. and continues until relieved by morphia. No vomiting follows pain. At first the attacks were neither severe nor frequent, but recently have occurred daily.

Tenderness at right ninth costal cartilage, along costal margin, and up back to right scapula.

At operation the great omentum was adherent to the distended gall-bladder, and this adhesion was ligated and dis severed. Lymphadenitis in lesser omentum, and head of pancreas enlarged and hard. Operation similar to that in previous case, except that cystic duct was ligated instead of being drained.

Frozen section showed chronic interstitial cholecystitis. Culture of bile sterile.

In the first attack this patient probably passed a calculus from the common duct, and, if so, the later course of the disease shows that,

aside from frank attacks of cutting biliary colic and rapid jaundice during the passage of a stone, most of the symptoms are caused by the inflammation and not by the gall-stones themselves. The chronicity here is a manifestation of lingering infection, as shown by the omental lymphadenitis and pancreatic lymphangitis, and these, in turn, were maintained by insufficient biliary drainage, which was becoming more and more interfered with, as the recent daily occurrence of the attacks indicated. Had no operation been performed at this juncture, the course first of Case XXXVII and later of Case XXXVI might have been followed.

In placing retractors in the left edge of the incision, be sure to get *under* instead of going through the suspensory ligament. There was an omental adhesion which was readily dis severed. But when firm union has taken place with the duodenum or other hollow viscus there is considerable danger of opening the bowel and contaminating the field. To obviate this the dissection should be made cautiously, keeping close to the gall-bladder rather than the bowel. In the case of fistulous communication between the gall-bladder and the bowel it will be necessary to open the tract, and this should be done with as little soiling and much protection of adjacent areas as is possible. Thus in a recent case of a single large stone in gall-bladder there was an inflammatory exudate binding that organ to pylorus. On separating this a perforation was found in pyloric antrum, evidently an attempt at cholecystogastrostomy in order to discharge the stone into the stomach. After cholecystectomy, the inflammatory mass was removed from stomach down to level of serosa, and the perforation closed by inverting sutures.

In some of these cases of chronic cholecystitis organisms may be lurking in the crypts and folds of the mucosa of the gall-bladder when they are not demonstrated by cultures of the bile. In others the inflammation invades the deeper layers of the walls and causes hyperplastic and proliferative changes, a condition that Kelly considered as the beginning of carcinomatous degeneration. The class of cases in which at present cholecystectomy is preferred to cholecystostomy is that in which a long history of recurrent febrile attacks is obtained, and in which operation shows more or less permanent gall-bladder changes and evidence of peripancreatic lymphangitis, often with some communicated inflammation of the head of the organ itself.

CALCULUS IN COMMON DUCT; REMOVAL; CHOLEDOCHOSTOMY; RECOVERY

CASE XXXIX.—Female, 40, complained of pain in right hypochondrium.

Six months ago began dull, aching pain in middle of back, and this continued and varied in intensity.

Six weeks ago, on awaking in morning, found body deeply jaundiced; got up and two hours later had severe cutting pain, beginning in middle of back and shooting around right costal margin to epigastrium and up over sternum. Later, nausea and vomiting. No chill or fever. Stools ashen colored; urine dark. Pain subsided in two days, and jaundice three days later.

Three days before admission another attack developed during the night. This time chills and sweats developed.

Right rectus muscle rigid. No tenderness. Jaundiced. Blood count: Hæmoglobin, 75; red blood-corpuscles, 3,720,000; white blood-corpuscles, 6750.

At operation the omentum major was adherent to suspensory ligament of liver. Numerous adhesions between anterosuperior surface of liver and diaphragm. Pyloric portion of stomach adherent to gall-bladder and liver immediately in relation with it. Gall-bladder contracted. Foramen of Winslow patent. Common duct distended: its identity was established by exploration with a hypodermic syringe, bile being withdrawn. A small incision was made into it, but the passage of a probe was interfered with by numerous gravel calculi. Duodenum and pancreas mobilized by incising the peritoneum that passes from the second portion of the duodenum to the kidney, and turned over toward median line. This gave access to the retroduodenal portion of the common duct. A calculus the size of a white grape was palpated near the ampulla of Vater, having formed for itself a diverticulum. It was impacted. Through an incision over the stone the latter was removed. It was ovoid and its surface was rough. In its wake streamed a large number of gravel calculi suspended in mucinous bile. These calculi probably indicated blockage of the ducts throughout the liver. A large rubber tube and a smaller "T" tube were introduced into and fastened in the common duct, and an attempt was made to lavage the biliary ducts through these tubes. The head of the pancreas was enlarged and hardened. An enlarged lymph-node was removed from the omentum minor in the angle between the lesser curvature of the stomach and the choledochus communis, and sent to laboratory for examination. Drainage consisting of two large rubber tubes and a Mikulicz cigarette drain was introduced so as to drain the subhepatic (renal) fossa and the anterior surface of the lesser omentum. Gauze pads removed, instruments accounted for, and incision closed up to drainage.

This patient exhibited the cardinal symptoms of choledochus obstruction. The findings illustrate Courvoisier's law that in calculous obstruction of the common duct the gall-bladder is contracted. One or more stones may be present in the common duct without causing jaundice. The common duct may be much dilated, and a case is on record in which the distended duct contained 800 Cc. of fluid and simulated an echinococcus cyst. A dilated choledochus may be mistaken for the portal vein, and when in doubt use a hypodermic syringe

to determine by aspiration which vessel the presenting structure is. There is a variation from the normal in the formation of the choledochus in which the cysticus and hepaticus join near the duodenum, and the hepatic duct entering posteriorly appears much as a branch of the cystic duct, the latter seemingly being continued directly into the common duct.

In the long run immediate operation during an attack of acute obstruction of the common duct is attended by less danger than is delay, for the patient may be spared the risks of cholangitis and cholæmia. Hemorrhage, one of the greatest dangers, does not occur in the early stages, but only in the cases where a cholæmic state has existed for a long time. The patient may be fortified against bleeding by large doses of human serum given subcutaneously.

When the stone is in the retroduodenal portion of the duct, every effort should be made to dislodge it into the supraduodenal portion, or, failing this, either to scoop it out entirely or reduce it with the spoon of the scoop and remove it piecemeal, or push it through into the duodenum. In this case it was necessary to employ Kocher's mobilization of the duodenum. Stones that have worked their way upward into the hepatic ducts are very difficult and, at times, impossible of extraction. These are one cause of the recurrence of symptoms after the removal of common-duct calculi. Another cause is cicatricial contraction of the incised choledochus. This is usually prevented by a T rubber tube so placed that its short arms project upward and downward into the duct, while the long arm is brought out of the incision for drainage. By this method the formation of a duct of sufficient lumen is favored, much as occurs in the urethra when a catheter is used in the same manner after a perineal section for stricture ("Surgery of the Common Bile Duct," *Med. Rec.*, Nov. 4, 1911).

STRICTURE OF COMMON BILE-DUCT; CHOLEDOCHOSTOMY; RECOVERY

CASE XL.—Female, 43, complained of jaundice.

Two and a half years previously was operated upon for cholelithiasis and empyema, and cholecystectomy and choledochostomy were performed. *B. typhosus* isolated from bile.

Three months later was operated upon for adhesions, which were found in the fossa of the gall-bladder and at the pylorus, from which they were inseparable. For this reason posterior gastrojejunostomy was performed, and choledochostomy was repeated.

Since eleven months has had attacks of chills, followed by fever and jaundice. The icterus had persisted: itching intense. Has had clay-colored stools. Urine at times almost green, and there is urgency and frequency of urination. Occasional pain under right costal margin.

Deeply jaundiced. Edge of liver two fingerbreadths below costal margin. No tenderness; no mass. Blood count: Hæmoglobin, 77; leucocytes, 8550; coagulation time, nine minutes.

At operation numerous old dense adhesions surrounded operative field and drainage tracts. Thick scar in fossa of gall-bladder. Omentum freed from liver. Common duct isolated: thickened, and near duodenal end somewhat dilated. Opened 2 Cm. from termination, permitting escape of dark green, viscid, fairly translucent bile and small specks of black material. More of this scale-like *débris* removed by scoop. T rubber tube placed into choledochus with short end toward and practically reaching bile papilla, and sutured to the duct. Closure.

Culture of bile showed *B. coli communis*.

Three weeks after operation skin was clearing steadily and drainage had almost ceased.

This case illustrates the closing observations upon the previous one. Stricture of the common duct is rare, and, if not the result of a previous operation, generally is due to trauma of a passing gall-stone. The symptoms are those of constant obstruction of the duct, as by pressure from without. The statistics of biliary disease for our five-year period are:

Year.	Cholecystitis.	Deaths.	Cholelithiasis.	Deaths.
1909	25	1	96	6
1910	32	0	97	5
1911	34	2	131	7
1912	38	2	130	12
1913	40	2	130	8
Totals	169	7	584	38

THE STOMACH

PYLOROSPASM; EXPLORATORY LAPABOTOMY; RECOVERY

CASE XLI.—Surgeon, 54, complained of recurrent attacks of discomfort at right costal margin.

Since five years has had attacks of discomfort, at times pain, at right costal margin, never caused nor influenced by eating. No belching, epigastric distention, nausea, or vomiting. No radiation of pain. No colic or blood in stool. Pain comes on without apparent cause. Long intervals of comfort.

Had appendicitis fifteen years ago—appendix removed.

Slight tenderness at Robson's point. Moderate fulness and slight resistance in right hypochondrium. Blood count: Hæmoglobin, 90; red blood-corpuscles, 4,930,000; white blood-corpuscles, 9000.

At operation through a curved incision in upper right rectus stomach, duodenum, pancreas, and gall-bladder were normal in thickness, size, and the usual pearly appearance. Distinct pylorospasm was seen on attempt to deliver lower end of stomach, and this organ showed considerable hyperirritability. Kidneys moderately movable. Closure.

Pylorospasm is an intermittent or constant contraction of the pyloric sphincter, and is usually only a symptom of some other malady, or of one of a number of diseases met with in the abdomen. It may simulate pyloric obstruction or merely cause discomfort in the epigastrium, as in this case. The phenomenon has been definitely connected with some cases of chronic appendicitis, in patients in whom the entire pain and distress were located in the epigastrium. Pylorospasm is often due to gastric ulcer and gall-bladder disease, and may be the only distinctive symptom in gastric polyp. Gastric dilatation may follow. The treatment is that of the underlying condition.

GASTROPTOSIS; GASTROPEXY; RECOVERY

CASE XLII.—Female, 48, complained of burning sensation in epigastrium, pain in right loin, and headache.

Two years ago began with gaseous distention after meals, irrespective of quality or quantity of food. Loss of appetite. Has lost five pounds in past year.

Bismuth-skiagram revealed marked gastroptosis, the organ extending into pelvis, and moderate gastrectasis; also, ptosis of transverse colon to two inches below navel. Blood count: Hemoglobin, 58; red blood-corpuscles, 3,180,000; white blood-corpuscles, 5800.

At operation through an upper right rectus incision stomach was found in pelvis. Left portion of gastrohepatic omentum was plicated by three double chromic catgut sutures, elevating stomach to its natural position in relation with visceral surface of liver. Regional organs normal. Closure.

This patient's stomach was ptosed to the extreme third degree, the lesser curvature having passed below the navel. The flatulence after eating, the disinclination to eat, and the loss of weight are characteristic symptoms, although ptosed stomachs, like ptosed kidneys, often give rise to no trouble. On the other hand, gastroptosis may constitute a physical basis for neurasthenia; while simple gastroptosis occurs alone, yet more often it is but part and parcel of Glénard's disease. In the majority of cases much comfort and even complete relief may be obtained by wearing a well-fitting abdominal binder, combined, perhaps, with the frequent daily assumption of the knee-chest posture, abdominal massage, and outdoor exercise. But in a small number of selected cases, as in this patient, operation may be performed with

benefit. Beyea's operation is not always feasible, for the gastrohepatic omentum may be attenuated to such an extent that the sutures tear loose. The thickest part of this sheet is the left side. Gastrojejunostomy is the operation with the widest application.

GASTRIC ULCER; POSTERIOR GASTROJEJUNOSTOMY; HOUR-GLASS STOMACH; GASTRO-PLASTY; RECOVERY

CASE XLIII.—Female, 42, complained of epigastric pain, vomiting, and dyspepsia.

One year ago had epigastric pain, which has increased on taking food and relieved by vomiting. Pain later radiated to back. Unable to eat solid food on account of pain. Hæmatemesis at that time.

Two months ago had a dull, gnawing pain and burning after ingestion of food. Pain recurs from one-half to three-quarters hour and again about three hours after eating, and is temporarily relieved by food and by vomiting. Pain is chiefly in epigastrium, and radiates to back.

Some rigidity and tenderness in epigastrium; none along spine. Gastric capacity, 1100 Cc. Blood count: Hæmoglobin, 59; red blood-corpuscles, 4,290,000; white blood-corpuscles, 11,300.

At operation through incision five inches long in upper right rectus stomach was found dilated and ptosed to near navel. Hour-glass shape with constriction at juncture of upper and middle thirds. On lesser curvature, midway between pylorus and cardia, is a large, partially healed ulcer, and just beyond pylorus the scar of a healed duodenal ulcer is seen. Gastric ulcer so large and so placed that excision was not possible. Incision in long axis of stomach across hour-glass constriction, and rent thus made sutured along transverse axis, thereby enlarging lumen of stomach. Posterior no-loop gastro-enterostomy made between lower, larger chamber of stomach and first portion of jejunum (the technic of this operation will be described with Case XLVI).

Hour-glass stomach is encountered in about seven per cent. of gastric operations. While it may be congenital, yet it is nearly always acquired, and the chief cause, as in this case, is gastric ulcer; while cancer, corset liver, perigastric adhesions, and ingestion of corrosive liquids less often play a part. The constriction is usually single, and is situated in relative order of frequency near the pylorus; midway between the orifices; and near the cardia. The greater curvature is more often involved than the lesser. When the constriction is situated near the cardia and the pyloric pouch is large there is danger in the first instance of the small cardiac pouch escaping the eye of the operator, and of a gastro-enterostomy being performed with the pyloric portion without improving the patient's condition; secondly, the pyloric pouch may undergo volvulus, the greater curvature ascending toward the left and becoming strangulated. The deformity is often

complicated by pyloric stenosis, from which it is rarely distinguishable; if near the cardia, cardiac obstruction is simulated. Inflation of the stomach might reveal the condition clinically, but more often it will be discovered in a bismuth-skiagram. The methods of surgical attack include digital divulsion; gastropasty; gastrogastrostomy; gastrojejunostomy; and partial gastrectomy ("Surgery of the Upper Abdomen"). Usually it is necessary to combine two of these procedures, as a gastrojejunostomy at the pyloric pouch with a gastropasty or gastrogastrostomy. It will be noted that this patient had both gastric and duodenal ulcers.

PERFORATED TUBERCULOUS GASTRIC ULCER; INVAGINATION; DRAINAGE; RECOVERY

CASE XLV.—Clergyman, 45, complained of pain and tenderness in abdomen, nausea, and vomiting.

Three years ago operated upon for perforated duodenal ulcer.

Seven months ago again operated upon for same condition.

At 5.40 A.M. of day of admission seized suddenly with severe cramps in epigastrium, followed by nausea and vomiting of liquid without relief.

Rigidity of right rectus; tenderness over upper portion marked. Peristalsis heard in left hypochondrium, but not below. Incisional hernia in upper abdomen at site of old scar. Blood count: Hæmoglobin, 60; white blood-corpuscles, 11,000.

At operation scar was excised and much free cloudy fluid found in upper abdomen. Pinhead perforation surmounting a chronically indurated area found on posterior gastric wall. Transverse mesocolon firmly adherent to this wall. No sign of previous gastro-enterostomy. Ulcer closed with silk in two layers by oversewing. Miliary tubercles along duodenum and jejuno-ileum; much butter-like material on mesentery and coils of gut. Glass tube inserted into pelvis through suprapubic incision, and much cloudy, non-odorous fluid escaped. Closure.

Pathologic examination of piece of omentum revealed tuberculosis.

Primary tuberculosis of the stomach is exceedingly rare, there being only about six cases on record. The infection here was doubtless secondary to that of the intestines, which are, almost without exception, involved when the stomach is affected. Perforation into the abdominal cavity is not common, usually being prevented by preceding perigastritis. The symptoms are those of gastric ulcer. The prognosis is influenced by the other tuberculous lesions. In the presence of pyloric stenosis it is bad without operation. If the disease is limited to the pylorus, and especially if primary, partial gastrectomy may be performed, but in most cases gastrojejunostomy is the operation of choice ("Surgery of the Upper Abdomen"). As in the previous case, this patient had both gastric and duodenal ulcers.

GASTRIC ULCER; PARTIAL GASTRECTOMY; POSTERIOR GASTROJEJUNOSTOMY; RECOVERY

CASE XLVI.—Travelling salesman, 47, complained of vomiting after eating.

Most of adult life has had attacks of biliousness, and especially after a banquet would vomit soon after eating.

Since three years has had attacks of vomiting, varying in frequency from once a day to three weeks, if on a diet. Attacks sudden, and preceded by weakness, heartburn, and belching. No epigastric pain. Vomiting afforded relief, but left him weak. Attacks induced by ingestion of fried foods. Has had hunger pains. Has lost about thirty pounds since three years. Never jaundiced; never required morphia.

Much rigidity and tenderness over epigastrium, especially at site of gall-bladder. Blood count: Hæmoglobin, 86; red blood-corpuscles, 4,590,000; white blood-corpuscles, 7300. Chemical examination of vomitus: Free acid, 30; total, 45. Of full meal: Free, 53; total, 83.

At operation the abdomen was opened by an incision five inches long through right rectus close to median line. Thickening found at pylorus, and because of doubt as to its benign or malignant nature, patient being in cancer age, it was deemed safest to perform partial gastrectomy, employing Billroth's second method. Special clamps were applied to duodenum one inch distal to pylorus and to stomach at Hartman's line, which is dropped perpendicularly from right end of cardia to greater curvature. Coronary, pyloric, gastroduodenal, and left gastro-epiploic arteries ligated. Omenta separated from curvatures of stomach. Intervening portion excised, being separated by electric cautery. Duodenal stump very short; edges inverted and held by purse-string suture of linen, reinforced by seromuscular sutures; stump buried by head of pancreas, affording greater security. Edges of gastric stump oversewn with iodized gut, inverted, and reinforced by two rows of seromuscular sutures.

Posterior gastrojejunostomy was performed by the no-loop method as follows: Transverse colon and greater omentum drawn upward over lower margin of thorax and to right, thus putting transverse mesocolon upon stretch and exposing duodenojejunal junction. Mesocolon torn through at a bloodless area to left of middle colic artery, and opening enlarged vertically to length of three inches. Posterior wall of stump of stomach drawn through rent. Roosevelt clamp applied with its axis running from patient's right shoulder toward his left hip, thus ensuring an obliquity of such nature that when the stomach, which is now turned upside down, is replaced, the incision into it will pass from above downward and to patient's right. Clamp included about three inches of gastric wall. First three inches of jejunum drawn between remaining blades of clamp in such fashion that the part at the duodenojejunal flexure lay toward the right, and the distal end of the third inch toward the left. The approximated loops with the intervening middle blade of the clamp resembled a short length of a double-barrelled shotgun. There were now inserted three posterior lines of sutures, the better to guarantee against hemorrhage and leakage. The first line (the segments being as yet unopened) was a continuous suture of Pagenstecher linen running close to and parallel with the middle blade of the clamp, and was seromuscular (the term "seroserous" is usually used in describing this stitch of Lembert, but as it includes the outer portion of the muscular coat, together with the serous, the term "seromuscular" is more accurately descriptive). Having reached the end of the

line, the needle was laid aside temporarily. An incision two and a half inches long was now made with the scalpel through the serous and muscular coats of the stomach about one-third inch distant from the continuous suture just inserted. The same coats of the jejunum were incised in similar manner. The mucous membrane herniated through each incision, but is not opened until after the second line of sutures has been inserted. This second line is now placed. Like the first, it is a continuous suture of linen and is so placed through the short one-third inch of stomach and jejunal walls as to approximate the serous surfaces that are included over this slight breadth between the first line of sutures and the cut edges of the stomach and bowel. Each mucous coat is now picked up with forceps and cut off with scissors, flush with the margins of each incision. Instruments and gloves changed. Adjacent free edges of stomach and jejunum next united by a through-and-through continuous suture of iodized gut (if a non-absorbable suture be inserted into mucosa, it might dangle in the ostium and cause a vicious circle). Beginning at one extremity of the incisions into stomach and jejunum, this needle is passed from the mucous surface of the jejunum through its wall to its serous surface, and from the serous surface of the stomach into the cavity of the latter. The suture is then knotted; and by continuing to suture in a precisely similar manner the posterior margins of the incisions are united from one extremity to the other. Reaching the end of these posterior margins, the suture is continued around it and the approximation of the anterior margins begun and completed in similar manner. Thus the needle is passed *out, in, and over, out* of one organ, *into* the other, and *over* the line of sutures, to again pass *out* of the jejunum, *into* the stomach, and across the suture line back to the starting point. About four or five stitches should be made to every inch. On reaching the original end of the stitch at the starting point the suture is tied. The clamp is now released and removed. A modification of this through-and-through suture for the anterior margins is as follows: The needle enters the serous coat, passes directly through all coats into the lumen, passes over the edge of the mucosa, and is inserted into the cut edge of the organ so as to enter it through the submucosa; it is pushed through the muscular and serous coats to emerge on the free surface. It is passed through the edge of the opposite organ in like manner. The advantage of this stitch is that it secures good hæmostasis of the mucosa and securely approximates similar coats of each organ. The seromuscular suture (the first posterior line), previously laid aside, is now resumed, reinforcing the anastomosis on its anterior aspect, and completing the circumference of the wound to its starting point, where it is tied to its own initial extremity and cut short. Gloves and instruments again changed. Seromuscular "anchor suture" placed at jejunal end of anastomosis to hold jejunal loop in contact with wall of stomach, thus preventing right-angle drag on end of ostium, with subsequent spur formation. Finally, edge of rent in mesocolon was sutured to wall of stomach just proximal to area of anastomosis (it is a technical error to suture this edge to either the line of anastomosis itself or to the jejunum) to prevent not only prolapse of a portion of stomach or intestine through the rent, but also the mesocolon from constricting the anastomosis itself or from slipping down over the afferent and efferent loops of jejunum and thus causing obstruction ("Surgery of the Upper Abdomen"). Gauze removed, posterior line of sutures inspected, viscera replaced, gauze pads and instruments accounted for, and wound closed.

Pathologic examination revealed an ulcer at pylorus.

Although no carcinomatous degeneration of this ulcer was revealed microscopically, yet in view of the facts that two-thirds of all cases of cancer of the stomach are engrafted upon old gastric ulcer; that in over three-fourths of cancer cases the carcinoma is situated near the pyloric end of the stomach; that the patient was in the cancer age and was having repeated attacks of vomiting; and that the risk of partial gastrectomy has been greatly diminished by improvement in technic, the operation in this case, though extensive, was wholly justified. The best treatment for carcinoma of the stomach is to operate in the pre-cancerous stage, for in this way such extensive disease as the next case shows will be prevented.

CARCINOMA OF STOMACH, JEJUNUM, OMENTUM; PARTIAL GASTRECTOMY; POSTERIOR GASTROJEJUNOSTOMY; RESECTION OF JEJUNUM; LATERAL ANASTOMOSIS;
RECOVERY

CASE XLVII.—Laborer, 34, complained of pain in lower abdomen.

Three weeks ago began to have pain in lower left abdomen, radiating across navel to right side, and then followed by nausea and vomiting. Pain colicky, but never severe and sharp, and as it subsided could feel peristalsis and gurgling. It was not related to eating, but he was nauseated and distended after eating. Felt better when stomach was empty. Appetite poor; extremely constipated.

No tenderness, masses or rigidity. Blood count: Hæmoglobin, 88; red blood-corpuscles, 5,010,000; white blood-corpuscles, 7200. Test breakfast strongly positive for bile; no occult blood; no free acid; total acidity 20; no lactic acid. Test meal positive for bile; faint trace of blood; free acid 30; total 46. Full meal positive for bile; faint trace of blood; free acid 32; total 50. Stool positive for bile; strongly positive for occult blood. Bismuth-skiagram revealed a marked point of constriction toward pyloric portion of stomach; sluggish peristalsis; no dilatation or ptosis of stomach.

At operation a small, hard mass was present in gastric wall near pylorus, and lymph-nodes along both curvatures were enlarged. Jejunum greatly distended, and an annular constriction was found in its lower portion, considerably narrowing the lumen. The two operations upon the stomach were performed in the same manner as in the previous case. The jejunum was resected, removing the constriction with the cautery; stumps oversewn and invaginated with purse-string suture of linen, reinforced by invaginating seromuscular suture of same material; lateral anastomosis performed. A section of great omentum containing enlarged lymph-nodes was ligated and removed. Closure.

Pathologic examination showed wall of pyloric portion of stomach 1 Cm. thick; on greater curvature, three nodules, very firm and hard, 1 Cm. in diameter; in great omentum numerous hard nodules, .05 to 2 Cm. in diameter. Bowel shows constriction in middle caused by hard, unencapsulated mass 3 x 3 x 4 Cm. On section this shows an infiltrating white growth. Microscopic examination of stomach, bowel, and omentum revealed adenocarcinoma.

A collective survey of the histories of these cases of gastric disease discloses the symptoms of chronic dyspepsia as being common to all. Chronic dyspepsia is also a manifestation of appendicitis and disease of the biliary tract. But it is with gastric dyspepsia due to ulcer, its complications and sequelæ, that we have to deal. In the first instance, it is of historical interest to note that, previous to the commencement of the period of operative invasion of the abdomen, the diagnosis of gastric disorders was shrouded in darkness, and the treatment empirical, the *indicationes morbi* being based upon the symptoms founded upon the correlation between clinical observations and post-mortem appearances. With the dawn of the new era, biopsy upon biopsy evolved the science of *living pathology*, the pioneers in which blazed the way for a remarkable insight into the manifestations of early gastric disease, their correct interpretation, and the substitution of early operative treatment for the quassia cup of old. When the education of the laity in gastric disorders reaches the pinnacle it has now attained in appendicitis, almost the closing chapter of the romance of abdominal surgery will have been written.

That we are far from this ideal, however, the mere recital of the above cases serves to show. In the length of time, often many years, that the patients endured their malady, as well as in the advanced pathologic conditions found at operation, are reflected not only the present shortcomings of diagnosticians, but also a lingering of the old opposition of patients to give their surgical advisers free rein to do what they *know* is best for them. The pioneer trail has been blazed; the surgeons have removed *their* tollgates; and when the laity removes those of its own building, a splendid highway shall remain along which sufferers will march in safety, and abandon their maladies by the wayside, again to rally under the banner and fall in line with the triumphant march of modern surgery.

The statistics of operations upon the stomach for our five-year period are:

Diagnosis.	Operation.	Number.	Deaths.
Carcinoma of Œsophagus...	Gastrostomy	4	2
Gastroptosis.....	Gastropexy	24	0
Gastroptosis.....	Gastro-enterostomy .	1	0
Gastrectasis	Gastroplication	1	0
Stenosis of Pylorus.....	Gastro-enterostomy .	7	1
Ulcer	Gastro-enterostomy .	10	0

Diagnosis.	Operation.	Number.	Deaths.
Ulcer	Gastrectomy, Partial.	7	2
Ulcer, Perforated	Gastrorrhaphy	3	0
Ulcer, Perforated	Gastro-enterostomy .	4	0
Carcinoma.....	Gastro-enterostomy .	23	4
Carcinoma.....	Gastrectomy, Partial.	8	4
Carcinoma.....	Gastro-gastrostomy .	1	0
Totals		93	13

DUODENAL ULCER; PYLORECTOMY; POSTERIOR GASTRO-ENTEROSTOMY; RECOVERY

CASE XLVIII.—Male, 35, complained of pain in right hypochondrium, nausea and vomiting.

Since three and one-half years has had four or five attacks at intervals of two to four months. Pain sharp, sudden, localized low in right hypochondrium, generally followed by nausea and vomiting. No pain on taking food. Has lost nineteen pounds during this time.

Abdomen soft. Complains of deep tenderness to right of and a little above navel, and under right costal margin.

At operation the healed scar of an ulcer was found on first portion of duodenum. Using the same technic described above (Case XLVI), pylorectomy was performed, followed by posterior gastro-enterostomy.

Pathologic examination revealed an ulcer 1 Cm. beyond the pylorus. The walls are thin, the serosa is inflamed with few adhesions, and the mucosa hemorrhagic and injected. Microscope revealed chronic inflammation.

This case corresponds to type in the sex and age of the patient; in the intervals of freedom from symptoms; in the absence of referred pain; and in the localization of tenderness. It deviates slightly in the presence of vomiting, which, in the absence of pyloric stenosis, is unusual in duodenal ulcer. In being situated in the first portion of the duodenum, it occupies the commonest (92 per cent.) location, a frequency that has been attributed to trauma from the chyme as it is squirted through the pylorus. The sharpness of the pain is explained by the inflammation of the serosa found on pathologic examination. The correspondence of the situation of pain and local tenderness with the location of the ulcer is of interest. At operation the ulcer was so benign in its pathology and so favorably situated as readily to lend itself to pylorectomy followed by gastro-enterostomy.

PERFORATED DUODENAL ULCER; DUODENORRHAPHY; GASTROJEJUNOSTOMY; RECOVERY

CASE XLIX.—Laborer, 20, speaks Italian only.

Day before admission taken sick suddenly with severe abdominal pain, followed by vomiting. His physician stated that he had an indefinite history of indigestion previous to present attack.

Abdomen very rigid throughout. Tenderness general, but most marked in right iliac fossa. Deep inspiration causes pain in right iliac fossa. No peristalsis heard. Rectal examination negative. There were 21,300 leucocytes just previous to operation, and the day after operation this number had been reduced to 9150.

Owing to the unsatisfactory history and the tenderness and pain on inspiration being most marked in the right iliac fossa, acute appendicitis was suspected, and the great rigidity suggested perforation.

At operation through an incision in right linea semilunaris the peritoneum was found injected, and appendix was exposed. Appendix not sufficiently diseased to explain great rigidity, and later was probably greater than could be explained by nervous apprehension. After removing the appendix, the pelvic cavity was explored for fluid, and a syringe of turbid, mucoid exudate was removed; this showed importance of exploring pelvis for fluid (just as important as exploration of bile-ducts for stone), as it adds no risks to the operation and often, as in this case, furnishes a surprise.

An incision was next made through upper right rectus, and lymph exudate was found just beyond pylorus; on drawing first portion of duodenum up an early perforation the size of a goose-quill was seen on the anterosuperior wall. The ulcer was inverted by seromuscular sutures, and this portion of the duodenum obliterated by being tucked in. Posterior gastrojejunostomy was performed according to the technic described above (Case XLVI).

Culture of peritoneal exudate proved sterile. Two weeks after operation patient was discharged, feeling fine.

Perforation is much more frequent in duodenal than in gastric ulcer. It occurs in about two-thirds of the cases of the former. The great frequency with which duodenal perforation simulates appendicitis should be borne in mind. Moynihan collected forty-nine operations for perforation of the duodenum, in eighteen of which the diagnosis had been appendicitis. Conditions favorable for gastrojejunostomy were the promptness of operative attack (within first twenty-four hours, mortality 37.7 per cent.; within second twenty-four hours, mortality 82.5), and the consequent good condition of the patient and the slight soiling (culture sterile) of the peritoneum. Two objections that have been raised against this are: First, that the peritoneum might become infected: this is met by the answer that in these cases of early perforation the fluid is usually sterile (as here); secondly, the additional time consumed: this varies with the skill of the operator. The advantages are that it takes the tension off the line of sutures that invert the ulcer; that it inhibits peristalsis, thereby affording physiologic rest; and that it admits alkaline pancreatic juice to bathe other ulcers that may exist, to which the juice is beneficial, just as is sodium bicarbonate to gastric ulcer. A

case has been reported by Dr. Deaver of a duodenal ulcer 2 Cm. in diameter, situated on the posterior internal aspect of the descending portion of the duodenum, which caused fatal hemorrhage by eroding a branch of the inferior pancreatico-duodenal artery (*Archiv. Diagnosis*, Jan., 1910).

CARCINOMA OF DUODENUM, PYLORUS, AND PANCREAS; CHOLECYSTODUODENOSTOMY;
RECOVERY

CASE L.—Male, 55, complained of pain in right upper abdomen and jaundice.

Since twenty years has had dyspepsia, manifested by gastric distention after eating, considerable belching, and acid eructations. No pain until present attack. Bowels always regular. Appetite good.

Five days before admission awoke with burning pain in right side of epigastrium, followed shortly by nausea and vomiting. Since then a dull pain has lingered.

Two days before admission became jaundiced: this has persisted, but is diminishing.

Has not vomited since the first day.

Moderate jaundice. Liver extends three inches below costal margin: edge palpable, smooth and sharp. Tenderness over hepatic and appendiceal regions. Rigidity on right side.

Blood count: Hæmoglobin, 84; red blood-corpuscles, 4,620,000; white blood-corpuscles, 4800. Test breakfast positive for occult blood, and showed free acidity of 45, total 65. Stool showed no bile, but a faint trace of occult blood. Urine very strongly positive for bile, and contained excessive amount of indican, and also hyaline and granular casts.

At operation, using stovaine and entering through upper right rectus, there was revealed carcinoma of duodenum, pylorus, and pancreas, the last obstructing the common bile-duct. Gall-bladder very tensely distended with rusty fluid, which was removed by trochar and cannula. Gall-bladder opened and swabbed with gauze. Cholecystoduodenostomy performed by direct suture, making a lateral anastomosis with an ostium about one inch in length. Closure.

Culture of bile revealed *B. coli communis*.

The twenty years of dyspepsia suggests a primary ulcer of the pylorus or duodenum with recent malignant degeneration and spread to the pancreas. Five days before admission an attack of acute localized peritonitis began, and the accompanying congestion produced complete blockage of the common bile-duct two days later. With subsidence of the attack of peritonitis the duct opened up again. The enlargement of the liver was due, if acute, to cholangitis, and if chronic, to secondary carcinoma. That the carcinoma had not existed long was shown by the high blood count and the fair condition of the patient. The presence of urobilin and the absence of bile from the stool were parts of the manifestations of obstructive jaundice. In Case

XXXIX there was an illustration of the part of Courvoisier's law which states that in calculous obstruction of the common bile-duct the gall-bladder is contracted in 80 per cent. In the present case is found corroboration of the remainder of that law, that in 90 per cent. of the cases of enlargement of the gall-bladder the obstruction is due to causes other than stones. The excessive amount of indican suggested intestinal mischief, while the hyaline and granular casts were the result of toxic nephritis.

Primary carcinoma of the duodenum is rare, and in all probability usually develops from a preceding ulcer. Many cases of primary involvement of the orifice of the common bile-duct have been reported. The absence of long-continued jaundice excludes such a mode of onset in this case. Of interest here is the following case of carcinoma of the duodenum reported by Dr. Deaver in the *Archives of Diagnosis*, July, 1908, in which the operation of excision of the duodenal wall, enterorrhaphy, and posterior gastrojejunostomy resulted in recovery.

Female, 34, Hungarian, since four months had vomited soon after meals. Since two weeks has had epigastric pain.

Tenderness midway between ensiform and navel, and a little to right of this region. Blood count: Hemoglobin, 75; red blood-corpuscles, 5,040,000; white blood-corpuscles, 8000.

At operation, on anterior wall of first portion of duodenum was a hard, infiltrated area, less than size of little finger-nail. This was removed and the rent repaired. Posterior gastrojejunostomy was performed. Many fine and dense adhesions were found between stomach and liver and between duodenum, gall-bladder, and stomach.

After operation vomiting ceased.

Histologic examination revealed evidence of chronic ulceration of the duodenal mucosa, and inflammatory hyperplasia with cystic dilatation of the ducts. Below the submucosa, and intimately adherent to it, is a carcinoma of the adenomatous type, seemingly derived from the pancreas, of which tissue there are some areas in the section.

In the present case the operation of cholecystoduodenostomy was the only one possible under the circumstances, and it was palliative in that it relieved the obstruction to the bile, as well as afforded better drainage of the pancreas.

DUODENAL STASIS; JEJUNOJEJUNOSTOMY; RECOVERY

CASE LI.—Female, 52, complained of chronic dyspepsia, repeated vomiting, and pain.

Seven years previously began dull ache in umbilical region, frequent belching, and jaundice, followed by sharp pain and then nausea and vomiting, with relief.

Two years previously an operation had been performed elsewhere. This consisted of an anterior gastrojejunostomy with long loop, using the Murphy button. Relief lasted eighteen months.

Six months previously symptoms returned, and pain was more severe.

Four days before admission an attack began with headache and nausea, followed the next day by vomiting of foul, fermented food. Later on in the same morning of the attack suddenly experienced sharp pain, more severe than in any other attack. Was chilly, and then feverish.

Old abdominal scar. No rigidity. Deep tenderness in upper portion of umbilical region, and in upper right side, so that deep inspiration is prevented. Blood count: Hæmoglobin, 89; white blood-corpuscles, 5550.

At operation through a high right rectus incision the anterior gastrojejunal anastomosis with a long loop was seen. Duodenum showed a little fulness, and a small band of adhesion was dissevered. The duodenal stasis was due to longitudinal duodenal adhesions, which were freed. A Murphy button, found in the ascending colon, was pushed down into the rectum and removed. Appendicectomy. Jejunojejunostomy was then performed by lateral anastomosis, making a short circuit of the long loop of the gastrojejunostomy. Closure.

Six weeks after operation patient had improved greatly and was much stronger.

The symptoms in this case were similar to those of chronic dilatation of the duodenum due to obstruction at the duodenojejunal flexure or pressure of the superior mesenteric artery. There are symptoms of pyloric obstruction, but at operation the pylorus is found patent. The Murphy button finds its best indication in anterior gastrojejunostomy, especially when rapid work is necessary. The finding of the button in the ascending colon two years after its insertion constitutes one of the objections to its use. It would have been better had the long jejunal loop been shortcircuited at the time of the first operation.

VICIOUS CIRCLE; PPLICATION OF DUODENUM; RECOVERY.

CASE LII.—Female, 34, complained of vomiting and pain along right side of abdomen.

Within the last thirteen years had had seven operations, including appendicectomy, nephropexy, and gastro-enterostomy with entero-enterostomy.

At operation the pylorus was open and the anastomotic orifices were patulous. No adhesions except between posterior parietal peritoneum and duodenum, and these were ligated and dissevered. Duodenum closed off by plication with two interrupted sutures of linen. Drainage. Closure.

After operation there was no further nausea or vomiting.

Vicious circle is now of historical interest, since it resulted from the long loop operations of gastrojejunostomy. The anterior route in the latter operation is seldom chosen, except in certain cases of carcinoma, and even then vicious circle is avoided by entero-enter-

ostomy. The long loop posterior route has been abandoned for the "no loop" method originated by Petersen, so that now such a sequel is rarely if ever seen.

Vicious circle following posterior gastrojejunostomy with long afferent loop may be dealt with by the following method:

1. Entero-enterostomy between the afferent and efferent limbs of the jejunal loop. If this fails to relieve,
2. Ligation of the pylorus should be the next step; while
3. Occlusion of the afferent loop between the entero-anastomosis and the gastrojejunostomy may be done as a final step (Deaver, "The Vicious Circle after Gastro-enterostomy," *N. Y. Med. Jour.*, 1906, i, 26).

The statistics of operation upon the duodenum for our five-year period are:

Diagnosis.	Operation.	Number.	Deaths.
Ulcer	Gastro-enterostomy	95	2
Ulcer	Gastrectomy, Partial ..	1	0
Ulcer, Perforated	Enterorrhaphy	3	0
Ulcer, Perforated	Gastro-enterostomy	18	1
Carcinoma	Gastrectomy, Partial ...	1	0
Totals		118	3

Comparison of numbers of gastric and duodenal ulcers:

Simple Gastric.	D.	Simple Duodenal.	D.	Perf. Gastric.	D.	Perf. Duodenal.	D.
17	2	96	2	7	0	21	1

Total gastric, 24; deaths, 2. Total duodenal, 117; deaths, 3.

According to this table, duodenal ulcer is five times more frequent than gastric.

PANCREAS

ACUTE GANGRENOUS PANCREATITIS; INCISION AND DRAINAGE; RECOVERY.

CASE LIII.—Female, 43, complained of pain and tenderness in upper abdomen, with jaundice and dyspepsia.

Twenty years ago had an attack of abdominal pain and vomiting. Pain lasted eleven hours, and was followed by chronic constipation.

Several years later had a similar but less severe attack.

Seven years ago attacks of abdominal pain became more frequent, the first being especially severe. Each attack came on suddenly with a tightening, oppressed, and distended feeling in epigastrium, with severe colicky pain, and followed by vomiting of green material, and later by belching of gas with some relief. At no time jaundiced. These attacks continued up to time of admission.

Present attack began four days ago, at two o'clock in the afternoon, with sudden, very severe, widely diffused abdominal cramps, which required large doses of morphine for relief, distention, and later vomiting.

Day before admission became jaundiced. Stools dark, and between attacks are normal.

General icterus. Abdomen distended, and rigid on right side. Mass in right loin space which is separate from liver; tenderness over mass.

Blood count: Hæmoglobin, 58; red blood-corpuscles, 4,730,000; white blood-corpuscles, 10,100. Urine positive for bile. Stool shows faint trace of bile. Cammidge "C" test negative. Fluoroscopic examination negative.

At operation an extra-peritoneal incision was made through the right loin, traversing the two oblique and the transversalis muscles. Much fluid showing evidence of fat necrosis and of colon infection was evacuated. Drainage by three pieces of gauze.

One month after operation had a sudden, severe abdominal pain, which was followed by collapse and profound shock. Skin cold and clammy and radial pulse imperceptible: condition very serious. Next day epigastric distention and tenderness. Two days later much improved.

Seven weeks after operation was out of bed and in good condition, and wound was practically healed.

During postoperative convalescence large pieces of necrotic material were discharged from the mound. Examination revealed gangrene and fat necrosis.

Culture from fluid revealed *B. coli communis*.

In the history of previous gastric disturbances (prodromal symptoms in the nature of gastric disturbances being present in 70 per cent. of cases); of the violent onset of severe colicky pain which required large doses of morphine; of early vomiting; of jaundice; and, later, of collapse, and of the appearance of a mass in the right loin space, we have the well-defined picture of an attack of acute pancreatitis. The low hæmoglobin percentage suggests anæmia, and, indeed, the first stage in the pathology of acute pancreatitis is hemorrhage with fat necrosis, both due to the destructive action of the pancreatic ferments, and the last stage is gangrene. Fat necrosis was seen both clinically and pathologically, while gangrene was found in the sloughs discharged after operation. As in this case, gangrene is usually manifested ten days to two weeks after the onset of the attack. The case was favorable for recovery owing to the absence of marked pre-operative collapse, and the early pointing of the products of inflammation in the loin, thus offering the best avenue for drainage by way of the posterior loin incision.

The source of the infection is probably along the lymph path, which runs from the gall-bladder along the right free border of the gastro-hepatic omentum surrounding the common bile-duct toward the head of the pancreas, there to anastomose with the lymphatics from that organ. Another source of infection is catarrhal duodenitis, either by direct regurgitation into the pancreatic duct, or else by extension along

the lymphatics to the retroperitoneal tissues and anastomosing pancreatic lymphatics.

The prognosis is fair under surgical treatment, and very gloomy under medical. Operative results are improving each year, while medical remain stationary.

Year.	Surgical mortality.	Medical mortality.
1906	83.3 per cent.	90 per cent.
1909	66.6 per cent.	90 per cent.
1911	38 per cent.	90 per cent.

The treatment is by immediate operation, *except during the primary collapse.*

As to the site of the incision, when there is a definite pointing in the lumbar region, or even marked tenderness without other signs, the lumbar route provides the best drainage with the least trauma. This incision is made as for kidney operations. Care is necessary not to penetrate the peritoneum; the dissection is carried beneath the lower pole of the kidney, and by burrowing with the finger toward the middle line little difficulty should be experienced in locating the pancreatic exudate. The abscess is freely opened, and drained with tube and gauze.

In cases which do not present the definite indications for lumbar attack the technic is as follows: Through an epigastric incision isolate the pancreatic region by gauze packs; if a collection of fluid exists, evacuate it by aspiration; expose the pancreas preferably through the gastrocolic omentum, and if it presents no gross lesions do not incise it, but merely tampon the lesser peritoneal cavity; if there is a hæmatoma or abscess in the pancreas, incise its capsule, and with a blunt instrument carry the incision into the substance of the gland, to secure drainage of all pockets of pus. Then tampon the incision into the pancreas, using a large rubber tube for drainage in the centre of the tampons. The head of the pancreas may be exposed by mobilization of the duodenum. The biliary tract should not be interfered with except for very positive indications and only when the patient is in reasonably good condition ("Surgery of the Upper Abdomen").

PANCREATIC LYMPHANGITIS; CHOLECYSTOSTOMY; RECOVERY

CASE LIV.—Male, 53, complained of epigastric pain referred up over chest. Since three months has had full feeling after meals and much belching of gas; also, constipation.

Day of admission, at five o'clock in the morning, began to have severe pain in mid-epigastric region, referred up over chest to back. One hour later vomited three times, greenish material. Never jaundiced.

Very tender and rigid over right hypochondrium. White blood-corpuscles, 13,100.

At operation through a curved incision in upper right rectus a small adhesion between duodenum and gall-bladder was found, and dissevered. Duodenum and pylorus normal. Pancreas slightly enlarged and irregularly nodular. Pancreatic lymph-nodes along common duct enlarged. Gall-bladder distended with black, viscid bile: no stones. Common duct found dilated; aspirated with syringe, no bile; opened and found patulous, no stone. Drainage consisting of one rubber tube placed in gall-bladder, and latter stitched to parietal peritoneum. One rubber tube inserted into subhepatic space. Closure.

Culture of bile was sterile.

The clinical symptoms in this case are those of the primary disease—cholecystitis, of which the patient had complained for three months. To these were added on the day of admission symptoms due to secondary infection of the pancreatic and peripancreatic lymph-vessels and nodes. In the preceding case the path by which the pancreas probably was infected was mentioned. The lymph-node, which is quite constantly present at the neck of the gall-bladder, drains but a small part of the lymphatics of this organ. The majority drain into two nodes, one at the junction of the supraduodenal and retro-duodenal portions of the common duct, one lying to the right of the head of the pancreas, between it and the common duct, and the other situated to the left of the head of the pancreas. The lymphatics in and about the pancreas anastomose freely. We are accustomed now to recognize extremely mild grades of inflammation of the gall-bladder by the presence of very slight thickening, diminution in lustre, increased opacity, or inspissation and tarry character of its contents. Filmy adhesions should not pass unnoticed; they are clear evidence of a previous inflammatory process. Although culture of the bile in this case was sterile, yet it is in the walls of the gall-bladder and ducts that the infection chiefly lurks. Thus, in a small series of fourteen cases of cholecystitis the pancreas was enlarged in nine (64.2 per cent.).

The course of events in this case must now be clear. Evidence of cholecystitis was shown, in addition to the history, by the adhesion between the duodenum and gall-bladder and by the tarry, inspissated nature of the bile. The infection spread to the cystic lymph-node and

then by a periductal lymphangitis through the nodes along the common duct to those at the head and margin of the pancreas, and thence to the regional lymphatic distribution to the head of this organ. Cholecystostomy in many instances is curative in a surprising manner, and must remain the operation of choice in the majority of cases. The subsidence of infection in the gall-bladder, brought about by this method of drainage, is speedily followed by disappearance of the lymphangitis dependent upon it. While it is an operation of slightly greater mortality than cholecystostomy, yet cholecystectomy has the advantage of prompt removal of the focus of infection, and also prevents recurrence of inflammation in the gall-bladder. Where the fate of the pancreas is concerned, however, these advantages must be taken into consideration, and therefore a proper balance must be struck between the immediate and remote dangers. Cholecysto-enterostomy should be reserved for those cases in which more or less chronic obstruction of the common duct is a feature (Deaver and Pfeiffer, "Pancreatic and Peripancreatic Lymphangitis," *Annals of Surgery*, Aug., 1913, p. 151).

CHRONIC INTERSTITIAL PANCREATITIS; CHOLECYSTODUODENOSTOMY; RECOVERY

CASE LV.—Chauffeur, 33, complained of frequent attacks of sharp pain in upper right abdomen, and of dyspepsia.

Since two years has had attacks of epigastric distress manifested by distention after eating and acid eructations, and followed by nausea and vomiting of greenish material. With these attacks there was a dull, gnawing pain in upper right abdomen radiating to epigastrium, not severe and not related to eating. But slight belching. Periods of freedom from all distress were followed by return of more severe symptoms. Bowels always regular.

Ten weeks ago had an attack in which the pain was so severe as to require morphine. Within a day or two deep jaundice developed and lasted a few days. Urine became brown and stools light yellow. No chill or fever.

Three weeks ago had a similar but more severe attack.

Rigidity of upper right rectus, and moderate tenderness over gall-bladder. Slight tenderness and resistance over whole epigastrium. No mass.

Blood count: Hæmoglobin, 86; red blood-corpuscles, 4,530,000; white blood-corpuscles, 7350. Test breakfast positive for occult blood; free acid 23, total 54. Full meal very strongly positive for occult blood; free acid 0, total 12. Stool strongly positive for bile, and very faintly positive for occult blood; many oil droplets.

At operation through an incision in the upper right rectus enlarged lymph-nodes were found along the free edge of the gastrohepatic omentum. Head of pancreas very hard and indurated like a mass; in fact, the whole pancreas was hard and enlarged. Gall-bladder distended. Duodenum mobilized by incising

posterior parietal peritoneum along right side of duodenum. Cholecystoduodenostomy performed. One rubber tube placed in subhepatic space. Closure.

Three weeks after operation patient felt fine and was discharged.

Culture of bile sterile.

With the exception of jaundice, the symptoms in this case are not dissimilar to those of the preceding one. It is the old, old story of long-continued, recurring dyspepsia. Chronic pancreatitis possesses, in common with chronic gastric, duodenal, and biliary disease, the property of exciting more or less epigastric discomfort, distress, or pain, which may radiate to hypochondrium or back. While this patient had most of the symptoms of chronic pancreatitis, the absent ones being fever, constipation, and loss of weight and strength, yet these are common to various upper abdominal diseases and do not of themselves, even when all are present, constitute a characteristic symptom-complex. A point of some negative value is the absence of definite relation of the pain to eating. The jaundice is an important symptom. It developed rapidly and gradually subsided. It is present in two-thirds of the cases, and is due to compression of the lower end of the common duct, which in about two-thirds of instances traverses the substance of the head of the pancreas, by the swollen pancreatic head.

As in the previous case, the source of infection was, in all probability, the gall-bladder, the pancreas being involved through the lymph-channels, and becoming the seat, in this case, of a well-marked and very extensive lymphangitis. Thus, of seventy-nine patients in the German Hospital with chronic pancreatitis, seventy-two (91 per cent.) showed evidence of infection in the bile-passages; forty-two (53 per cent.) had gall-stones, and in thirty (38 per cent.) there was non-calculous inflammation.

The principle of treatment in this case is quite obviously drainage of the source of infection. In fact, gall-bladder drainage is the sheet-anchor in the treatment of pancreatitis. Many cases of mild pancreatitis are completely and permanently relieved by simple cholecystostomy with drainage continued from *four to eight weeks*. In the presence of the ordinary indications for cholecystectomy, and when the gall-bladder is thickened and functionless, this organ should be removed and drainage instituted by choledochostomy. When there is marked swelling of the pancreas with obstruction of the common duct and jaundice, as in this case, temporary drainage of the biliary

tract does not insure against relapses, and permanent drainage, as by cholecystoduodenostomy, must be instituted, even though the mortality be higher than in cholecystostomy.

A sound should always be passed through the common duct into the duodenum, to make certain that the passage is permeable. The probe should be sufficiently large to secure full dilatation of the duct and the opening of the papilla of Vater. It is probable that spastic or cicatricial contraction of the sphincter of the papilla (sphincter of Oddi) plays a part in some cases. It is at times rather difficult to force the sphincter with a large probe, which suggests the possibility of cicatrix or sphincterismus, of which we see analogies at other orifices of the body that are guarded by sphincters ("Pancreatic Lymphangitis and Chronic Pancreatitis," *Jour. A. M. A.*, 1913, *lx*, 1).

Pancreatitis must still be studied with an open mind in regard to its etiology, and particularly in respect to its relation to chronic inflammatory diseases of the alimentary tract that result in retroperitoneal lymphangitis. Treatment is promising in the early stages and practically hopeless when the stage of interstitial deposit of fibrous tissue or of cancer is reached. Our most promising lead for treatment consists in the means already devised for the treatment of chronic inflammation in the organs with which pancreatitis is commonly associated and on which it appears to be dependent. Finally, pancreatitis is common and not rare; its presence should be suspected in all cases of obscure upper abdominal indigestion; and, like other chronic inflammatory lesions of the abdomen, when it is uninfluenced in a reasonable length of time by medical measures, it should receive surgical attention along the lines here proposed.

CARCINOMA OF PANCREAS; CHOLECYSTOSTOMY; PANCREATOSTOMY; RECOVERY

CASE LVI.—Female, 43, complained of pain in upper abdomen and dyspepsia.

Eight months previously began to suffer from pain in epigastrium after eating, dyspepsia, but no vomiting. Habitually constipated. Never jaundiced.

This pain gradually became more severe, and belching much freer and accompanied by acid eructations. Abdomen always very tender after pain. Complained of pain in back, "girdling" in nature. Stools very black.

Abdomen fat and flabby. Marked resistance in upper right hypochondriac region and in middle of epigastrium; tenderness in same areas. No palpable mass.

Blood count: Hemoglobin, 33; red blood-corpuscles, 2,260,000; white blood-corpuscles, 11,250. Stomach contents: Free acid, 0; total acidity, 23; lactic acid

strongly positive; Oppler-Boas bacilli numerous; trypsin present in abundance. Stool: Black; bile, positive; occult blood, positive. Cammidge "C" test at first negative, but a week later positive.

At operation gall-bladder found thickened and showed evidence of previous chronic inflammation. Flakes of necrosed fat seen in great omentum. Gastro-hepatic omentum incised, exposing pancreas. Large mass, size of two fists, involves whole pancreas: edges hard, centre soft. Pancreas grayish-green and necrotic. Incision made into body of organ allowed escape of pus with much necrotic material with foul sweetish odor. About two-thirds of necrosed pancreas scooped away, some pieces being as large as a walnut. Pancreas drained by spiral tube, and one piece of gauze sutured to organ. Counter-incision made through upper left rectus for drainage. Gall-bladder opened and sutured to peritoneum of anterior abdominal wall.

Pathologic examination showed that specimen consists of chronic inflammation tissue infiltrated with adenocarcinoma and showing at several points small lymph-nodes consisting of single follicles with a mantle of leucocytes.

Culture from gall-bladder wound revealed *B. coli communis*, and from pancreatic drainage, *B. pyocyaneus*.

It is the belief of this clinic that carcinoma of the pancreas is in many instances brought into existence by previous pancreatitis. This is in line with the well-known fact that chronic irritation predisposes to cancer, as is seen in *ulcus carcinomatosum* of the stomach and duodenum, cancer of the gall-bladder with non-calculous or calculous cholecystitis, and many other forms of the disease elsewhere. The reason for this belief is the observation that not a few cases of cancer of the pancreas present a long history of antecedent upper abdominal indigestion that suggests pancreatic inflammation prior to the development of carcinoma. The chain of events in this case, chronic indigestion, the evidence of chronic inflammation involving the gall-bladder and pancreas, and the later development of carcinoma of the pancreas, is at least suggestive. The patient made an operative recovery, but has since died of the disease.

The distribution of primary carcinoma of the pancreas is as follows: Head, 62 per cent.; body, 3.5 per cent.; tail, 5.5 per cent.; diffuse growth, 29 per cent.

The clinical course of a case of carcinoma of the pancreas is remarkable for its rapid progression to a fatal termination. The interference with pancreatic digestion, the jaundice, and the cachexia from a malignant tumor combine to make this one of the most rapidly fatal of malignant diseases. Death usually ensues within six to eight

months after the appearance of jaundice, but it may be delayed for two or even four years after the onset of the earliest symptoms.

Statistics show that operation is of little or no value in cases of carcinoma of the head of the pancreas either in effecting a cure or prolonging life. In cancer of the body or tail the prospect is slightly better, but not at all hopeful ("Surgery of the Upper Abdomen").

CYST OF PANCREAS; MARSUPIALIZATION; RECOVERY

CASE LVII.—Negress, 24, complained of abdominal pain and swelling, but no *dyspepsia*.

Eighteen months previously had slight pain in abdomen, and felt a hard, tender mass about size of baseball in left side. It has caused but slight pain, and has gradually grown to present size.

Since two months has complained of pains in back and of soreness in epigastrium. Never nauseated; has never vomited; not constipated.

Marked distention of abdomen by a symmetrical, round tumor of a type resembling pregnancy. It is confined to middle portion of abdomen; is pear-shaped, and most prominent near pelvic brim. Feels like large cyst. No foetal heart sounds. Vaginal examination shows that cervix uteri is freely movable and not enlarged. Evidently this is not an ovarian cyst; it must come from above.

Blood count: Hæmoglobin, 90; red blood-corpuscles, 3,560,000; white blood-corpuscles, 6750.

At operation free greenish fluid escaped through the incision. On enlarging latter a cyst is seen above, which is adherent to spleen and transverse mesocolon. It is evidently connected with the pancreas, since it pushes the transverse colon and small intestine down into the pelvis. Trochar and cannula inserted, and about 3000 Ccm. of thin, grayish-green, odorless fluid withdrawn. Walls of cyst stitched to edges of abdominal wound, and rubber tube inserted into cavity of cyst for drainage. Counter-incision made just above pubes, and glass tube inserted.

After operation the rubber tube drained freely for thirty days. There was a peculiar, sweetish odor to the fluid. Ten weeks after operation the fluid was almost clear and slight in amount.

Pathologic examination of fluid showed a thick, grayish-green, turbid collection which consisted chiefly of pus. It was of neutral reaction, rich in albumin, odorless, and had 95 per cent. of polymorphs. No trypsin or diastase; culture negative.

Cysts of the pancreas are classified as true and false. The true include those due to retention of pancreatic secretion, cystic new growths, hydatid cysts, and congenital cystic disease. False cysts arise in close association with the pancreas and involve it secondarily, usually being formed by effusions (hæmatomata), the result of abdominal injuries. Huge cysts are said to be associated with obstruction of the large branches of the main duct, and vary in size up to

enormous proportions, cysts containing fifteen litres and more having been reported.

The character of the contents varies from a watery fluid to a thick syrupy or colloid substance too thick to run freely through a trochar. It is purulent if suppuration has occurred. Pancreatic ferments are not necessarily present. The fluid may have as characteristics an alkaline reaction; a specific gravity of from 1010 to 1020, although it may be much higher; the constant presence of albumen; the frequent presence of cholesterin; the occasional presence of mucin; and rarely traces of urea. Microscopic examination reveals red and white blood-corpuscles, epithelium, fat globules, necrotic tissue, and frequently cholesterin crystals.

There are many cases similar to this one, in which the only symptom is the appearance and gradual growth of an abdominal tumor, but these are exceptional. The presence of the tumor and the associated inflammatory and pressure changes usually result in marked digestive and constitutional changes. Pain also is a fairly constant symptom.

Pancreatic cysts are divided into three classes, according to the direction of the growth (Körte). The first group comprises those tumors that grow forward between the transverse colon and the stomach, displacing the latter upward and the former downward. The second group includes growths from the upper part of the anterior surface of the head or body of the pancreas which grow forward below the liver and above the lesser curvature of the stomach, displacing the latter downward. The third group comprises cysts from the tail of the pancreas which grow into the transverse mesocolon and displace the colon upward, downward, or directly forward.

A cyst may disappear by being ruptured or as the result of discharging its contents into the bowel by way of the pancreatic ducts, or by means of a fistulous opening; this is followed by profuse diarrhœa of material resembling cyst contents or saliva.

The diagnosis is made fairly certain in the majority of cases by the history, the relation existing between the stomach and colon, and signs of pancreatic insufficiency, if present.

As the cyst enlarges, pressure symptoms become marked, and interference with pancreatic function causes loss of weight and strength and later probably diabetes. Suppuration is not very infrequent.

Sudden enlargement accompanied by symptoms of shock indicates hemorrhage into the cyst. Among eleven operations for pancreatic cyst performed in this clinic, there was one death, a mortality of 9 per cent.

As to the treatment, incision and drainage (marsupialization) is the most suitable operation in the majority of cases. The cyst wall should be fastened to the abdominal wall, but not to the skin. Occasionally drainage through the loin is easier than through the abdomen. As a rule, granulations gradually obliterate the cavity and it closes completely, but occasionally a small fistula may persist for years. Antidiabetic diet hastens the closure of the fistula ("Surgery of the Upper Abdomen").

CYST OF PANCREAS; RUPTURE FOLLOWED BY PANCREATIC FISTULA; EXCISION OF FISTULA; RECOVERY

CASE LVIII.—Female, 27, complained of fistula in left hypochondrium.

Five years ago had attacks of dyspepsia which lasted six months. These were characterized by pain immediately after eating, followed by vomiting. At times the pain was relieved by eating. On subsiding, a dull pain in left side of epigastrium persisted. No jaundice; no hæmatemesia.

Three years ago fell and struck lower left chest and shortly afterward noticed a lump in the region where previously the pain had been felt.

Since two years this lump has grown, giving rise to sensations of weight and fulness.

Two days previous to admission the lump ruptured externally, discharging large quantities of white, cloudy fluid; since then has felt less pain and sensation of weight. Bowels regular.

In left hypochondrium is a fistula about 3 Cm. below costal margin which exudes clear mucus that is very irritating to skin and which is surrounded by a red, excoriated area 5 Cm. in diameter. A probe is guided directly down to pancreatic region for a depth of nearly 10 Cm.

Blood count: Hæmoglobin, 80; white blood-corpuscles, 6700. Stool was grayish-brown, contained fat, and gave positive bile reaction. Cammidge test positive. Skiagram did not show necrosis of rib. Chemical examination of fluid: White of egg showed some digestion after incubation of twenty-four hours; starch solution showed no sign of digestion and no reduction by Fehling's test.

At operation through an incision in left rectus the fistula was followed down to pancreas. Tract ligated close to pancreas and cut away. Stomach was small, and was adherent to anterior abdominal wall just mesial to and below fistula. Closure.

This case is of much interest in connection with the observations made upon the previous case, and also in correlating the clinical history with the pathologic findings.

Both patients were within the age of incidence of pancreatic

cysts, namely, twenty to forty. This patient first complained of a dyspepsia that might have been due to a cholecystitis followed by pancreatic lymphangitis. The fall upon the left chest two years later, followed by the appearance of a lump which increased in size until it ruptured externally, recites the development of a hæmatoma the result of injury to a diseased pancreas, with the subsequent development of a pancreatic cyst and its rupture externally with relief of symptoms. All the laboratory examinations corroborated the disease of the pancreas, and the fistula possessed the characteristics described with the closing remarks of the previous case. It was not mentioned there that a pancreatic fistula might rupture externally, so that this must be a very rare occurrence.

The following table of affections of the pancreas, culled from the records of our five-year period, are of interest in exemplifying almost all combinations of biliary with pancreatic disease, as well as of operations for the same. There are also isolated diseases of the pancreas. The statistics reflect directly the advances in our knowledge of the surgery of the pancreas, although it would be inconvenient here to tabulate these cases in chronologic order.

Disease.	Operation.	Cases.	Deaths.
Pancreatitis, acute.....	Exploratory cœliotomy	1	1
Pancreatitis, acute.....	Cholecystostomy	1	1
Pancreatitis, acute.....	Choledochostomy	1	1
Pancreatitis, acute.....	Pancreatostomy	2	1
Pancreatitis, acute.....	Cholecystostomy and pancreatostomy ..	1	1
Pancreatic lymphangitis	Cholecystostomy	2	0
Pancreatic lymphangitis	and cholecystitis.....Cholecystostomy	10	0
Pancreatic lymphangitis	and cholelithiasis.....Cholecystostomy	7	2
Pancreatic lymphangitis	and cholelithiasis.....Choledochostomy	1	0
Pancreatic lymphangitis	and cholelithiasis.....Choledochostomy and cholecystostomy ..	1	0
Pancreatic lymphangitis	and cholecystitis.....Cholecystectomy	1	0
Pancreatic lymphangitis	and cholelithiasis.....Cholecystectomy	2	0
Pancreatic lymphangitis	and cholelithiasis.....Cholecystectomy and choledochostomy ..	1	0
Pancreatitis, chronic....	Cholecystostomy	13	0
Pancreatitis, chronic, and	cholecystitis.....Cholecystostomy	3	0

Disease.	Operation.	Cases.	Deaths.
Pancreatitis, chronic, and cholelithiasis.....	Cholecystostomy	9	0
Pancreatitis, chronic, and cholelithiasis	Cholecystostomy and choledochostomy .	2	0
Pancreatitis, chronic, and cholelithiasis.....	Choledochostomy	24	2
Pancreatitis, chronic, and cholelithiasis	Choledochostomy	1	0
Pancreatitis, chronic...	Cholecystenterostomy	16	1
Pancreatitis, chronic, and cholelithiasis.....	Choledochostomy	1	0
Pancreatitis, chronic, and cholelithiasis.....	Cholecystectomy	1	1
Pancreatitis, chronic, and cholecystitis.....	Cholecystectomy and choledochostomy .	1	0
Pancreatitis, chronic, and cholelithiasis.....	Cholecystectomy and choledochostomy .	5	0
Pancreatitis, chronic....	Drainage, cystic duct	1	0
Pancreatitis, chronic....	Pancreatotomy	1	0
Carcinoma of pancreas.	Celiotomy, exploratory	7	2
Carcinoma of pancreas.	Cholecystostomy	2	0
Carcinoma of pancreas.	Cholecystogastrostomy	1	0
Carcinoma of pancreas.	Cholecystoduodenostomy	3	2
Cyst of pancreas	Excision	4	0
Cyst of pancreas	Drainage	4	0
Totals		130	15

SPLEEN

SPLENOPTOSIS; SPLENOPEXY; RECOVERY

CASE LIX.—Female, 29, complained of mass in abdomen, pain, and constipation.

Since birth of child, eighteen months ago, has had pain in lower abdomen. Pain dragging in character. Headache; backache; frequency of micturition.

Hard tumor about size of man's fist to left of and below navel. Blood count: Hemoglobin, 84; red blood-corpuscles, 4,210,000; white blood-corpuscles, 2800.

At operation through incision in lower left rectus tumor was identified as spleen, which was three times normal size. Pedicle long, lower border of spleen being in Douglas's *cul-de-sac*; slight torsion of pedicle; vessels very tortuous and engorged. Through a second incision in upper portion of left rectus the gastro-splenic omentum was sutured in two places with double chromic catgut, and the long ends were drawn through rectus and anchored there, after the manner of a uterine ventral suspension. An additional suture of same material was inserted down through muscle into omentum, anchoring spleen and drawing it up into its normal position.

As is the case in ptosis of other viscera, prolapse of the spleen occurs most frequently in women, and relaxation of the abdominal walls following childbirth doubtless plays the most important rôle, as here. It may exist without symptoms, and may be part of a general abdominal ptosis. Increased weight is a factor in the etiology, although in the majority of cases of splenomegaly perisplenic adhesions and hypertrophy of the ligaments keep the organ in place.

The ptosed spleen may undergo torsion on its pedicle. If acute, the tight twist causes necrosis of the spleen and thrombosis of the splenic vessels. If chronic, the loose twist causes only gradual interference with the blood supply, resulting in enlargement from congestion of the organ, hemorrhage into its substance, and consequent increase of fibrous tissue. In this form intermittent attacks of pain associated with local tenderness are the only symptoms of moment. Attacks of perisplenitis cause the same symptoms. Rectal tenesmus is caused by impaction of a dislocated spleen in the pelvis. As a rule, the displacement, the swelling, and the formation of an inflammatory exudate obscure the physical signs and render diagnosis difficult. When the spleen becomes fixed to the uterus or adnexæ, it may be mistaken for a tumor of these organs. In one case it was mistaken for a displaced kidney, and operation wrongfully commenced by lumbar incision.

For cases of movable spleen discovered accidentally no operative treatment need be undertaken. For those cases complicated with twists, perisplenitis, and adhesions operative treatment is indicated, and consists in splenopexy or splenectomy, preferably the latter. Of seventeen operations for wandering spleen, splenectomy was performed in fourteen, splenopexy in two, and exploratory celiotomy in one. All the patients made uneventful recoveries ("Surgery of the Upper Abdomen"). Recent statistics presented by Finkelstein, of Baku, Caucasus, show that of sixty-six operations upon the spleen sixteen were for ptosis. Of these sixteen, five occurred in males and eleven in females. Splenectomy was performed upon thirteen and splenopexy upon three. Twelve recovered and four died.

Comparison of the course of events in this case with the above outline shows that dragging pain in the lower abdomen followed childbirth (descent of spleen from overstretching and relaxation of abdominal wall, and tugging on its pedicle); and that backache, con-

stipation, and frequency of micturition arose (pressure symptoms from impaction of spleen in pelvis). At operation there was slight twisting of the pedicle, the vessels were tortuous and engorged, and the spleen three times its normal size (chronic torsion). That it was fibrosed from the chronic congestion will be shown directly. Unfortunately the symptoms persisted and splenectomy was necessary (see next case).

SPLENOMEGALY; SPLENECTOMY; RECOVERY

CASE LX.—Female, 29, splenopexy for splenoptosis performed eight months previously (see Case LIX).

After operation remained well for three months, when symptoms recurred. Chief symptom was heavy, dragging, constant pain in left hypochondrium, worse at night and increased immediately after eating. Severe headaches. Appetite good, but curbed on account of discomfort. Does not vomit.

A freely movable mass three times the size of the normal spleen found in the left side of abdomen. It is smooth, dull on percussion, and not tender. An indentation is felt along its margin. Patient is three months pregnant. There is a double mitral heart murmur. Blood count: Hæmoglobin, 63; red blood-corpuscles, 3,460,000; white blood-corpuscles, 3800.

At operation through an elliptical incision around the scar the spleen was encountered immediately. It was densely adherent to line of incision by its upper and lower poles, being vertically placed. The upper adhesions, which were continuous with the pedicle, were clamped, cut, and ligated. Vessels of pedicle enormously dilated. It was necessary to denude an area of spleen to allow of separation up to the pedicle, which was then doubly clamped, cut, transfixed, and doubly ligated. Adhesions of lower pole clamped, cut, and ligated, and spleen removed. Closure.

After operation there was a perfectly normal convalescence. Four days after operation blood count showed: Hæmoglobin, 55; red blood-corpuscles, 2,830,000; white blood-corpuscles, 9450.

Spleen measured $17 \times 10 \times 4.5$ Cm. Cut surface reddish-brown, soft, and greatly congested, there being much free blood. Microscopic examination revealed chronic splenitis.

Success in the first operation of splenopexy depended absolutely upon the complete restoration of the circulation of the spleen to normal. That this did not occur, and that the circulation went from bad to worse, was shown by the enormous dilatation of the vessels at the second operation, and by the great amount of congestion seen in the enlarged spleen. These changes, the result of torsion of the pedicle, may lead to peritonitis and intestinal obstruction. Such complications are responsible for the high percentage of mortality. Thus of seventy-seven operations gathered elsewhere, thirteen resulted fatally. Of these, two died of thrombosis of pulmonary artery, one of con-

secutive hemorrhage, and one of pneumonia. Since in most cases the operations are performed upon a considerably changed spleen, the most efficient treatment must be splenectomy. This procedure generally gives satisfactory results, as, from the technical standpoint, it presents practically no difficulties.

SARCOMA OF SPLEEN; SPLENECTOMY; RECOVERY

CASE LXI.—Female, 38, complained of mass in left hypochondrium, pain, chills, fever.

Six months previously noticed mass in left hypochondrium, and since then dull pain on exertion, and occasional chills, fever, and sweats.

Recently has been much weaker. Appetite poor; markedly constipated. No pulmonic, intestinal, or urinary symptoms.

Patient anæmic. Abdomen soft and flaccid. On left side is a tumor that extends from costal margin to iliac crest. It is freely movable. Lower end of mass is bossed.

Blood count: Hæmoglobin, 51; red blood-corpuscles, 3,510,000; white blood-corpuscles, 9950; negative for malaria plasmodia and Widal reaction. Stool negative for parasites.

At operation an incision was made on the left side, extending from costal margin to opposite anterior superior iliac spine: where incision encountered external border of left rectus, latter was displaced, but elsewhere incision passed through oblique muscles. Small quantity of free, serous fluid present. Spleen exposed; cortex, especially at lower pole, showed whitish areas the size of a thumb nail or larger. Intestines walled off with gauze pads. Gastrosplenic omentum and lienorenal ligament clamped in turn, cut, and spleen removed. Pedicle transfixed and ligated. No hemorrhage, but puriform material exuded. Spleen very large, and weighed about three pounds. Owing to adhesions at upper pole, splenic tissue was cut there, and raw surfaces oversewn. Closure. One rubber tube inserted into splenic chamber.

Spleen measured 25 x 15 x 11 Cm., and was firm and nodular in area. Microscopic examination revealed round-cell sarcoma; acute splenitis; marked hemorrhage, and a considerable amount of connective-tissue proliferation.

Blood count two days after operation showed: Hæmoglobin, 45; red blood-corpuscles, 3,890,000; white blood-corpuscles, 43,050.

Six weeks after operation patient was discharged in good condition.

Sarcoma is the most frequent tumor of the spleen. The prognosis is gloomy. Death takes place several months after operation from recurrence or metastases. Of the sixty-six cases referred to above, in only two instances did recovery last over six years.

In the observations following Case IX mention was made of splenic anæmia occurring in a patient who had an adenoma of the thyroid gland, and that it was decided to postpone operation upon the thyroid with a view to performing splenectomy. Removal of the spleen for

splenic anaemia of the adult type is followed by excellent results. If the pedicle gives much trouble, the clamps may be left on for seventy-two hours, then loosened, and removed the next day.

There were no additional operations upon the spleen during the five years.

APPENDIX VERMIFORMIS

ACUTE GANGRENOUS APPENDICITIS; ABSCESS; APPENDICECTOMY; DRAINAGE; RECOVERY

CASE LXII.—Farmer, 16, complained of pain in lower right abdomen, followed by vomiting.

Four days before admission was attacked suddenly by a colicky pain, soon followed by vomiting. Pain, at first referred to navel, became widespread and then localized in right iliac fossa. Constipated.

Examination reveals pain in right iliac fossa during deep inspiration. Rigidity of right side of abdomen. Tenderness on pressure over right lower quadrant of abdomen, especially outer part. Tenderness also present on palpation through rectum. Temperature 101°; pulse 120. White blood-corpuscles, 20,000.

At operation an oblique incision was made from above iliac spine back into loin in the direction of the fibres of the external oblique. Pus found to outer side of caecum. Distal portion of appendix found free as a slough; proximal portion removed. Pelvis explored for pus, but none was found. Wound packed with several pieces of plain gauze, and edges of wound approximated over gauze to prevent escape of intestines in the event of a fit of coughing.

The three cardinal symptoms of acute appendicitis—pain followed by vomiting; tenderness; and rigidity of the abdominal wall—are too well known to merit discussion here. The history and findings of the case just recited are very typical. An important step in the diagnosis, and one that is frequently neglected, is examination through the rectum. This is particularly valuable in children and in cases in which the appendix is deeply situated behind the caecum. In estimating the degree of infection clinically, the pulse is of more value than the temperature.

On admission this patient was suffering from diffusing peritonitis, which localized and thereby became operable. In making the incision the abdominal wall was disregarded, the better to approach the infection. If incisional hernia result, it may be repaired later. This is the "wide open" treatment, and is necessary to save the patient. The pus, being to the outer side of the caecum, was in a situation from which may arise a subphrenic abscess immediately, and, more remotely, Jackson's membrane and Lane's kink, which are not congenital, but the results of inflammation. No pus was found in the pelvis.

It is a matter of great importance to determine this point in every case, not only to prevent residual abscess, but also to determine other sources of mischief, as, for example, when a case of perforated gastro-intestinal ulcer is mistakenly diagnosed acute appendicitis.

A long experience with acute appendicitis teaches one that its effects may be widespread. It may be the primary focus of metastatic infection to the following organs or regions: (1) Liver, through the lymphatics, but more often through the radicles of the portal system. Thus there may arise a subphrenic abscess (lymphatic infection); a liver abscess from septic pylephlebitis (portal system); and cholecystitis, non-calculous eventually calculous, from infection of liver *via* portal system, and stagnation of infected bile in the gall-bladder, the common duct escaping primary infection by virtue of its patency. (2) Stomach, through the lymphatics, causing gastric ulcer. (3) Duodenum, by the same route, causing duodenal ulcer. (4) Peritoneum, spreading by contact and producing diffusing peritonitis. (5) Preperitoneal areolar tissue, resulting in retroperitoneal cellulitis. (6) Pelvis, infecting by contiguity the right fallopian tube and producing acute tubo-ovarian disease as an immediate effect and extra-uterine pregnancy as a remote effect.

Experience also shows that symptoms simulating acute or chronic disease of the appendix may be due to movable right kidney, renal or ureteral calculus, cholecystitis or cholelithiasis, pancreatitis or simple or perforated gastric or duodenal ulcer, right-sided tubo-ovarian disease, bands or adhesions such as are commonly spoken of as Lane's kink of the ileum and membranous pericolicitis, an abnormally movable cæcum, and, finally, to one of a number of very uncommon conditions, such as typhlitis, suppuration at the internal ring, etc. The left-sided appendix of *situs inversus viscerum* has never been encountered in this clinic, and, if not suspected by the result of the routine examination of other organs, when inflamed it may give rise to considerable confusion in diagnosis. It may be said, incidentally, that absence of the appendix has never been observed.

As to the treatment, it is now almost universally accepted that in every case of appendicitis seen early operation is indicated, regardless of the mildness of the attack and regardless of the severity of the attack. Operation upon a case of pure appendicitis, when the mischief is confined to the appendix, usually presents no difficulties. When

the disease has spread beyond the confines of the appendix, however, so that the complication of peritonitis is introduced, treatment becomes difficult, and its success is usually a matter of surgical judgment.

The medical treatment of acute appendicitis consists of the following:

(1) Diagnosis. (2) Avoidance of purgative or laxative medicine. (3) The institution of anatomic and physiologic rest. (4) *Immediate preparation for removal of the appendix.* Anatomic and physiologic rest are secured by the following measures:

(1) Complete rest, preferably in the sitting posture to aid in the gravitation of exudates, if any, toward the pelvis.

(2) Absolute prohibition of anything by mouth, including water and ice, as well as nourishment, in order to quiet peristalsis.

(3) Gastric lavage to relieve stomach of accumulated fluids, preventing, in large degree, toxæmia, vomiting, and peristalsis.

(4) The constant instillation of normal salt solution by way of the rectum, according to the method devised by Murphy. This diminishes thirst and supplies the need of water.

(5) Ice-bags over the abdomen to quiet pain, to assist in keeping the patient quiet, and, more particularly, to discourage meddling examinations.

As to drugs, gastric sedatives are worse than useless. Morphine, if given indiscriminately, masks the symptoms, interferes with the phagocytic activity of the leucocytes, and inspires both patient and physician with false confidence. The pain of appendicitis is not often so great as to require morphine, but if necessary it should be given in a *minimum* dose only after decision for operation has been made. Under the above treatment the pain abates, and no anodyne is needed.

When the disease has spread beyond the confines of the appendix, as in this case, there may be one of several conditions:

(1) A strictly localized abscess without signs of diffusion and without peritoneal irritation. This demands immediate operation.

(2) A localizing abscess with diffuse peritoneal irritation. This, as a rule, is more safely treated by waiting until the active peritoneal inflammatory symptoms have subsided. It must be remembered, however, that there may be leakage from a weak abscess wall, and that this can give rise to a severe form of diffuse peritonitis. Therefore, a per-

centage of this type of cases should be operated upon in the presence of peritoneal symptoms.

(3) A circumscribed peritonitis with a diffuse peritoneal irritation. In these cases there is practically the same symptom-complex that is shown in an established diffuse peritonitis. When such a process is at its height it is often impossible to say whether we have really a diffuse or a circumscribed peritonitis.

As regards the approach to the localized abscess of the first group, the extraperitoneal route is best when feasible. Many of these have, as a part of their retaining wall, the parietal peritoneum of the right iliac fossa or the loin. When the infectious area has thus been excluded from the general cavity, the collection must not be attacked transperitoneally by tearing down the defensive adhesions between the intestines and omentum. However, there are many cases in which the abscess is not in so favorable a situation, and must be attacked transperitoneally. In such instances protection of the general peritoneal cavity must be secured by the disposal of gauze packs during operation, and the arrangement of drainage when the infected area has been dealt with. Even here adhesions must not be broken up unnecessarily, but only enough thoroughly to deal with the abscess cavity. It is not the breaking up of adhesions, but the institution of drainage, that cures.

The removal of the appendix in these abscesscases has been a mooted point. In 356 operated cases of acute appendicitis, the appendix was not removed in fifteen, or 4.2 per cent. An effort to find the organ should always be made, but there is a limit beyond which it is not safe to pass. Of course, the appendix need not be left in any case that can be so securely closed as to obviate incisional hernia. But when free drainage is required, as in this case, while in leaving the appendix there is a slight danger of recurrence of an attack, yet this can be obviated by a second operation for removal of the organ at the same time that the operation for the inevitable ventral hernia is performed. To remove the appendix certainly does not assist in recovery from the attack itself, while the breaking up of adhesions and burrowing about in the inflammatory exudate in the effort to locate a buried organ are surely dangerous.

It is to be noted that on admission this patient was suffering from diffuse peritonitis which, under appropriate treatment, localized, and

thereby became operable. The question of operation in these cases is a very delicate one, and usually depends upon the stage in which the patient is first seen by the surgeon. In the early stage of diffusing peritonitis, which is still local though unconfined, immediate operation should be performed. Clinically, this stage extends well up toward forty hours after the onset of the disease, though there are cases in which the process is more rapid than this. In removing the appendix, it is prevented from pouring out more infective material into the peritoneal cavity, the dosage of bacteria already present being insufficient to set up a diffusing peritonitis, but is speedily overcome by the resisting mechanism of the body.

Thus, if treated within the first forty hours after perforation, or even within the first fifty hours, it has become in experienced hands a condition associated with a comparatively low mortality, about one per cent. On the other hand, the alarming rise in mortality which ensues after passage of the fifty-hour line casts a perilous responsibility upon the procrastinator. By this time peritonitis has become well established, and, if so rapid and virulent that it marches ahead of the formation of plastic peritoneal adhesions, which seek to confine it to its origin, there results a diffuse peritonitis. Many who recover after such an attack do so only after a battle with sepsis, which depletes their physical powers, wastes their resources, and, at times, leaves impairments, such as fecal fistula, phlebitis, adhesions and ventral hernia, and even, in one case, postoperative insanity. It is impossible always to differentiate between a diffused and a diffusing peritonitis; or a localized peritonitis with diffusing peritoneal irritation; or between a diffuse and general peritonitis. Upon careful study and examination, however, a correct opinion as to the intra-abdominal lesion present may be formulated in a fairly clear manner.

In these cases ill more than forty to fifty hours the decision as to operation depends upon the presence or absence of some definite localizing sign of the original seat of the peritonitis. When the patient's abdomen is uniformly rigid or uniformly distended and no point of excruciating tenderness can be detected in the right iliac fossa, flank, or loin, and the appendix cannot be located in the pelvis by rectal or vaginal examination, no operation should be performed, but the treatment already described as that of anatomic and physiologic rest should be instituted. Operation under the above circumstances, with its

depression of the vital powers and resistance, will tip the scale against the patient. Anatomic and physiologic rest, however, will often tide over the crisis, cause subsidence in the remote areas of the peritoneum, and localize the infection in the neighborhood of the appendix, where it may be dealt with to greater advantage and with every prospect of success. So soon, then, as a well-localized area of rigidity and tenderness is well marked and the evidence of peritoneal irritation has practically disappeared, operation offers a much greater percentage of recoveries than in the stage immediately preceding this condition.

The essential treatment of appendiceal peritonitis may be summed up as follows: (1) early operation; (2) light anæsthesia; (3) rapidity of operation; (4) appropriate treatment of appendix; (5) avoidance of flushing and evisceration; (6) proper drainage; (7) simple postoperative treatment by posture and proctoclysis, with pre-digested beef for nutritional requirements.

During the five-year period there were 1518 cases of acute appendicitis operated upon, with 55 deaths, a mortality of a trifle over three per cent.

CHRONIC APPENDICITIS; APPENDICECTOMY; RECOVERY

CASE LXIII.—Chemist, 37, complained of pain in right lower abdomen.

One month ago had a sudden, sharp pain in right iliac fossa, followed by nausea and vomiting. Pain lasted for four days and then disappeared.

Two days previous to admission began to have pain and soreness in right iliac fossa. Pain was not general at first, but was localized to the fossa, and was followed by vomiting.

Tenderness and rigidity in right iliac fossa. White blood-corpuscles, 9100.

At operation through a McBurney gridiron incision the aponeurosis of the external oblique muscle was nicked and torn through, exposing the interabdominal fascia over the internal oblique muscle. This was incised, and the internal oblique and transversalis muscles were separated with the handle of the scalpel. The cæcum presented into the wound, and the anterior longitudinal band was traced down to the base of the appendix. Meso-appendix ligated and cut at attachment to appendix. Appendix clamped near base and ligated with iodine catgut. Electric cautery applied between clamp and ligature, and appendix was burned through. Stump invaginated into a pocket on outer surface of cæcum by seromuscular sutures of linen. Closure.

The external oblique aponeurosis was nicked and torn through because this method was recommended by McBurney in the original description of his operation in 1893. The internal oblique and transversalis muscles often cut hard. When opening the peritoneum avoid cutting the cæcum, which usually presents into the wound. The

appendix is usually to be found in the ileocaecal peritoneal fossa. When working through such a small incision, replace and deliver the gut alternately, lest more intestine be gotten out than can be returned. Plenty of margin of meso-appendix is left, the better to control hemorrhage. There is often bleeding from a vessel in the angle between the appendix and the cæcum: this must be carefully looked for and controlled. Iodine catgut is used to ligate the appendix only when it is intended to use a purse-string suture, for otherwise there is danger of the ligature yielding too soon. The electric cautery sterilizes and thromboses the stump. In sewing up, evert the peritoneum by mattress suture to prevent interposition of connective tissue. In this operation the upper portion of the transversalis muscle has a tendency to pull upward, and must be brought down to meet the bite of the needle which secures it together with the internal oblique. No dressing was applied to the wound: it was merely painted with iodine. By this method there are no more infections than in the old way, and much gauze is saved.

The diagnosis of chronic appendicitis is favored by its being the most common intra-abdominal ailment, and the appendix being the seat of localized tenderness. When in doubt as to the presence of upper abdominal disease, make a "compromise" incision, midway between both regions. Explore the pylorus, and then the lesser curvature of the stomach, feeling for ulcers. If pylorospasm be present as an effect of chronic appendicitis, the pyloric portion of the stomach may be injected. Inspect the duodenum, the gall-bladder, and the pancreas. If these organs be normal, the appendix may be readily removed through the wound.

When symptoms persist after the operation, they may be due to several causes. First, adhesions may be present either as a result of the appendiceal disease, or the operation itself; secondly, secondary changes in other organs may have occurred—for instance, there is reason to believe that cholecystitis and cholelithiasis and ulceration of the stomach or duodenum may depend in some obscure way upon chronic appendicitis; * third, the functional derangement, when of

* Of 5000 appendices removed in the Mayo Clinic during the course of routine abdominal operations, a condition of partial obliteration of the lumen was found in 26.9 per cent. of cases in association with gastric or duodenal ulcer, in 50 per cent. with cholecystitis, and in 44.8 per cent. with cholelithiasis.

long duration, may have become engrafted as a habit upon the physiologic activities of the alimentary tract; fourth, the diagnosis may have been mistaken. Stomach trouble often turns out to be appendix trouble. Pain in the epigastrium, distress after eating, nausea, belching, vomiting, and the protean forms of indigestion may be caused by chronic appendicitis without symptoms or palpable evidence of disease in the right iliac fossa. Certain of these cases, if watched closely, will have slight exacerbations of the local process during which the diagnosis may become clear. In other cases the state of affairs will become evident only by abdominal section, as mentioned above, when a negative examination of the upper abdominal viscera, coupled with the finding and removal of a chronically diseased appendix, followed by recovery from symptoms, will substantiate the diagnosis. Examination by the pathologist of many appendices removed in this clinic as an incidental procedure when operating in the neighborhood has shown that a large percentage of these appendices present unmistakable evidence of past or present inflammation. It seems that local pain does not necessarily accompany inflammation, but is present only when colic is caused, when the intra-appendiceal tension is raised by stricture or retention, or when the serous surface is involved in the inflammation. In a few cases chronic appendicitis proceeds by slow stages to complete obliteration of the organ, which is Nature's method of spontaneous cure, without noteworthy symptoms of any kind, and without any symptoms such as now are recognized as pointing to the appendix. These remarks illustrate the difficulty of recognizing existing chronic appendicitis, though it may be present in an advanced degree.

During the five-year period 2153 cases of chronic appendicitis were operated upon, with three deaths.

TUBERCULOSIS OF APPENDIX; APPENDICECTOMY; RECOVERY

CASE LXIV.—Female, 26, single, milliner, complained of pain in right lower abdomen.

Patient was born in Whitehaven, Pennsylvania, where a tuberculosis colony is situated.

Since eight years has had several attacks of pain in right lower abdomen.

Since one year has had two severe attacks of pain in that region, but always preceded by indigestion and pain in upper abdomen.

One week before admission, after supper, had an attack of indigestion char-

acterized by sudden, sharp pain in upper abdomen, which, two days later, localized in right lower abdomen, when it was followed by vomiting. Constipated.

Tenderness to deep palpation at McBurney's point. But slight rigidity.

Blood count: Hæmoglobin, 78; red blood-corpuscles, 4,490,000; white blood-corpuscles, 12,200.

At operation through a lower right rectus incision the cæcum was firmly bound to parietal peritoneum by adhesions, in which the great omentum participated. Marked infiltration of cæcum around base of appendix and of appendix itself, which was thickened and deeply imbedded in lower and outer portion of wall of cæcum. A band that held the ileum down was dissected and a portion of adherent omentum removed. Appendix removed by electric cautery. Drainage, consisting of one piece of gauze and one rubber tube, was placed against cæcum. Uterus and adnexæ inspected and found normal. Closure.

Microscopic examination of appendix revealed tuberculosis. Culture from peritoneum sterile.

After operation the wound healed very slowly.

In another patient, a negress, the serous coat of the appendix was studded with miliary tubercles, and the surface of the cæcum was salmon-colored and similarly involved. The stump of the appendix was not invaginated, owing to the presence of the tubercles. The operation will hardly benefit the patient. She will be given tuberculin. The leucocyte count was 5000, thus illustrating the leucopenia of tuberculosis.

Tuberculosis of the appendix is rarely, if never, primary, but is usually secondary to tuberculous disease of the ileocæcal region. Unless of the miliary variety, it is liable to escape detection upon macroscopic examination. If the disease be of the miliary variety, it should not escape detection; it is usually associated with similar disease of other intra-abdominal organs or tissues, particularly the peritoneum. In almost all cases, as in this one, there is associated a more or less circumscribed tuberculosis of the peritoneum. Tuberculosis of the appendix does not manifest any very marked tendency to perforation, though such eventuality may occur. The lesions, however, tend to the formation of fistulæ.

Tuberculosis, either latent or active, is a very grave complication of appendicitis. The underlying condition may be one not only of diminished power of resistance to the influence of agents provocative of acute inflammation, but also, in some instances at least, the consequence of dormant tubercle bacilli being roused into activity by the appendiceal disease. Be this as it may, the fact is certain that protracted convalescence, the development of multiple abscesses or of a

fæcal fistula, and other debilitating results, are to be greatly feared in the tuberculous subject. Indeed, it is questionable whether it is always wise to remove an appendix from an undoubtedly tuberculous subject, except for acute disease ("Appendicitis," Fourth Edition, 1913).

During the five-year period there were five cases of tuberculosis of the appendix, with no deaths. The number of acutely and chronically diseased appendices removed was 3671. In a case of tuberculosis of the large intestine appendicostomy was successfully performed.

MYXOSARCOMA OF APPENDIX; ABLATION; APPENDICECTOMY; RECOVERY

CASE LXV.—Tailor, 39, complained of occasional pain in right loin.

Since two months has had dull, aching pain in right loin, and pain on micturition. Constipated.

One month before admission noticed for the first time the abdominal tumor, at the same time that the dull, aching pain in the right loin started. Tumor was at first small, but gradually grew. He could move it about. No history of injury to abdomen.

On deep inspiration a globular mass, semi-solid in consistency, extending to the left almost as far as the mid-line, may be grasped between the two hands and shifted about.

Skiagram revealed a well-marked shadow in the right renal region, which was not affected by deep inspiration. Cystoscopic examination showed normal and equally functioning kidneys. Urine negative for tubercle bacilli. Blood count: Hæmoglobin, 75; red blood-corpuscles, 4,250,000; white blood-corpuscles, 12,000.

At operation through a long upper right rectus incision which extended to below the navel a tumor the size of a cocoanut, adherent to the tip of the appendix and the meso-appendix, was delivered. The appendix served as a pedicle for the tumor, and permitted considerable range of motion. On close inspection the tumor and tip of the appendix were found to be intimately associated. The adhesions of the meso-appendix were separated to permit access to the appendiceal artery, which was clamped. The appendix was separated from the cæcum by the electric cautery, and, with the tumor at its tip, was removed. Closure.

Pathologic examination of the appendix showed that it was 2.5 Cm. in length. Its distal end is continuous with a globular mass measuring $13 \times 10 \times 8.5$ Cm. Microscopically the tissue is composed of stellate embryonic connective-tissue cells, with much delicate intercellular fibrillæ and a hyaline matrix. (A sketch of this tumor may be found in "Appendicitis: Its Diagnosis and Treatment," Fourth Edition, 1913, p. 125.)

This tumor offered an interesting problem in clinical diagnosis. Sarcoma occurs as primary in the appendix, but only about nine authentic cases are on record. The growth is usually of the small round-cell variety or lymphosarcoma. There is generally an early in-

vovement of the cæcal wall, and its degree of malignancy is unaltered. Sixty-six per cent. of the cases occurred in the male sex.

CARCINOMA OF APPENDIX; APPENDICECTOMY; RECOVERY

CASE LXVI.—Female, 45, complained of dull, dragging pain in upper right abdomen, vomiting, and constipation.

Two years previously had been operated upon for biliary calculus.

Four months after operation had dull, dragging pain and soreness in upper right abdomen.

Nine months previous to admission began to suffer from loss of appetite, nausea and vomiting after eating, and languor, headaches, insomnia, and constipation. Has a constant pain in upper abdomen radiating to back, but not sharp and lancinating, as was the gall-stone colic.

Great tenderness in right upper abdomen on light palpation. Peristalsis very poor. Slight distention over whole abdomen. No tenderness over appendix.

Bismuth-skiagram showed that stomach was slightly dilated and ptosed, the lowest point reaching to 2.5 Cm. below navel. Peristalsis poor: stomach does not begin to empty itself in the usual time. Blood-count: Hæmoglobin, 70; red blood-corpuscles, 4,520,000; white blood-corpuscles, 7200.

On excising scar of previous operation great omentum was found adherent to it and to hepatic flexure of colon. Omentum released and ligated with iodine gut. Gall-bladder released from parietal peritoneum, to which it had been sutured at previous operation. It was normal. All adhesions were disevered. Upper abdominal viscera negative. Appendix adherent to cæcum posteriorly. Appendix removed by electric cautery. Closure.

Pathologic examination showed that appendix measured 3 x 6 Cm.; serosa very slightly injected; wall thickened; mucosa swollen; lumen patent, narrowed; contents, faecolith. Diagnosis, obliterative appendicitis. Microscope revealed carcinoma of appendix, early, and localizing to interior of organ.

One is immediately impressed with the fact that the carcinomatous appendix was not responsible for the symptoms complained of by the patient. These were obviously due to the adhesions, which were greatest at the site of the previous operation of cholecystostomy. It was by a fortuitous removal of the organ that the very early carcinomatous degeneration of the chronically diseased appendix was revealed. Two lessons may be learned: First, the wisdom of removing the appendix routinely in the course of abdominal operations for other conditions; second, the liability of a chronically diseased organ to undergo malignant degeneration. Thus of 5000 appendices removed in the Mayo Clinic during the course of routine abdominal operations, previously mentioned with Case LXIII, cancer was found in twenty-two, being apparently developed, as in the gastric carcinomas derived from simple ulcer, from islets of epithelium which, by the process of obliteration

tion, had lost their connection with the remaining mucous surface of the appendix.

More and more cases of carcinoma of the appendix are being reported every year, and this is doubtless due to the increasing custom of the routine examination of this organ. This disease is found in comparatively young subjects, the average age being about thirty years. The prevailing type of carcinoma is the spheroidal cell, which form not only attacks young adults, but also is less prone to give malignant metastases. These neoplastic growths are usually associated with inflammatory changes which characteristically lead to obstruction of the lumen, as in this case. For the most part the distal portion of the organ is the seat of the cancer. Carcinoma of the appendix is clinically benign, but histologically malignant.

During the five-year period there were three cases of carcinoma of the appendix, with no deaths. During this period the combined number of appendices removed, both acutely and chronically diseased, was 3671, so that in this series carcinoma of the appendix was found about once in a thousand cases.

And now neither space nor time permits us to linger much longer in this fascinating clinic. Of the affections of the intestines we had selected to report cases of adynamic ileus; volvulus of ileum; perforated typhoid ulcer of ileum; fecal fistula; cæcoptosis; tuberculosis of intestines—appendicostomy; carcinoma of colon; diverticulitis of sigmoid; sigmoidoptosis; multiple adenomatous polypus of sigmoid; and carcinoma of rectum. We can only present the most interesting intestinal case, and after that a hurried review of two of the subjects in which Dr. Deaver is particularly interested, namely, hysterotomy and prostatectomy. The remaining cases, which illustrate fairly completely the affections of the genital and urinary systems of both sexes, must for the present be left out of consideration.

INTESTINAL OBSTRUCTION DUE TO INTESTINAL PARASITES, BEANS, PEAS; RESECTION OF SIXTEEN INCHES OF BOWEL; RECOVERY (SEE FRONTISPICE)

CASE LXVI.—Female, 17, mill worker, complained of pain in lower abdomen and vomiting.

Felt perfectly well, ate everything, worked, and had no symptoms of any kind until day before admission, when, at ten o'clock in the evening, there came on suddenly severe abdominal cramps, followed by nausea and vomiting. These symptoms continued until time of admission, when felt very weak.

Patient is small, thin, nervous, anæmic. Eyes are sunken; facies drawn.

Abdomen tympanitic, generally tender, and rigid. Tumor in lower mid-abdomen, rounded, firm, smooth, 13 Cm. in diameter. Active peristalsis above tumor. Rectal examination unsatisfactory, owing to restless state of patient. Blood count: Hemoglobin, 98; red blood-corpuscles, 4,580,000; white blood-corpuscles, 12,350.

At operation through an incision in lower right rectus free peritoneal fluid escaped. About one foot of the lower end of the ileum was distended with semi-solid material. Numerous white flakes over small bowel. In places serosa was ruptured from distention, so that muscular coat protruded. A segment of ileum 40 Cm. in length was resected. Distal end invaginated with linen sutures. Proximal end implanted into sigmoid. Appendix removed. Closure without drainage.

Pathologic examination showed that the resected bowel was 40 Cm. in length, and that it was partially distended and loaded with undigested food, as peas and lima beans, and one or more *Tænia saginata* (see Frontispiece). Entire mass markedly injected. Culture from serosa sterile, but *B. coli communis* was recovered from mucosa.

After operation patient had a ravenous appetite, and on one occasion tried to swallow an entire lemon. At first while in hospital did not seem to be in her right mind, but after operation became quite herself again. Was discharged to go to a convalescent home, and directed to return later to take a vermifuge.

The interesting feature of this case revolves entirely about the curious nature of the obstruction. Cases of intestinal obstruction due to intestinal parasites have been reported in the literature, but it is extraordinarily rare to encounter blockage over a distance of sixteen inches by unchewed, unmastered, and undigested food mixed with tapeworms. That this patient's nervous system was affected seems clear. Various nervous phenomena, including great mental depression and hypochondria, are not infrequent in women, and perhaps the tapeworm secretes a toxin that influences the nervous system, just as the typho-lumbricosis of Marie affects the intestines in cases of ascariasis. The unchewed state of the food in a girl of seventeen with good teeth of itself suggests temporary mental aberration. The patient was very difficult to control immediately after operation, while later on she became quite herself again. On the other hand, many patients harboring intestinal parasites show no mental disturbances whatsoever.

SUPRAPUBIC HYSTEROTOMY

For nearly a decade Dr. Deaver has been a warm advocate of suprapubic hysterotomy when it is desired to establish a prompt and certain diagnosis if a reasonable suspicion exist of malignant disease of the interior of the uterus, and for the prompt termination of pregnancy in cases where life is acutely endangered by the continuance of that

condition. Illustrative of these situations four cases have been selected from the records of the past two years. The first two cases fulfil the first indication, and the remaining two the second.

HYDATIDIFORM MOLE; SUPRAPUBIC HYSTEROTOMY; RECOVERY

CASE LXVII.—Patient, aged 46 years, complained of pain and the presence of a tumor in lower abdomen.

Two months ago first noticed a swelling on left side of abdomen, which has rapidly increased in size since. Has a dull, aching pain across lumbar regions.

Since six weeks has had constant metrorrhagia and a scanty yellowish leucorrhœa. Constipated.

Lower abdomen presents a firm, hard mass size of adult's head, extending to navel. Movable. Cervix is dilated and uterus freely movable. Blood count: Hæmoglobin, 72; red blood-corpuscles, 4,330,000; white blood-corpuscles, 6250.

At operation with patient in Trendelenburg position an incision through the lower right rectus exposed a symmetrically enlarged uterus. Intestines walled off with gauze pads. Uterus grasped in volsellum forceps. Anterior surface of uterus incised down to peritoneal reflexion of bladder, which was carried forward. Contents of uterus, a mass of blood-clot with hydatidiform mole, were evacuated. Uterine cavity swabbed with tincture of iodine. Uterine wall stitched together by a double row of continuous sutures of stout catgut for the musculature, extending down to, but not through, the endometrium, and a single continuous suture of linen for the peritoneal coat. Instruments and sponges accounted for. Closure of abdomen.

Pathologic examination revealed a mass of tissue 19 x 12 x 3 Cm., soft and friable, and consisting of multiple small cysts, intermingled with a blood-clot the size of a hen's egg. Diagnosis, hydatidiform mole. Vaginal smears showed the presence of gonococci.

Hydatidiform mole is a curious condition that is met with now and then at the German Hospital, there having been four cases within our five-year period with no mortality. It is due to myxomatous degeneration of the chorionic villi. The change takes place in the endochorion, which forms the inner of the two layers that compose the chorion and is continuous with Wharton's jelly. True mucous tissue is overproduced within the villi. The process usually begins before the third month, at a time when the villi are almost equally developed over the whole ovum, so that the chorion is uniformly involved (Hirst). The mass may attain an enormous size—that of a man's head—and the cysts vary in size from that of a millet-seed to that of a hen's egg. The diagnosis is difficult, but the condition may be suspected if there be a rapid increase in the size of the uterus, especially toward the third month, and if blood escape at intervals during the early months of pregnancy. If the vesicles escape, which

is rare, the diagnosis is, of course, conclusive. Untreated, the chorion might invade the uterine wall, causing hemorrhage and possibly perforation, and, if the mass be retained, malignant degeneration of the epithelium might occur. A case of hydatidiform mole associated with deciduoma malignum occurred at the German Hospital within recent years. In most cases the diagnosis will probably be made at operation, which has been performed to detect the cause of irregular metrorrhagia during the early months of pregnancy. That hysterotomy is the operation of choice in this condition is evident. It is superior to the induction of abortion *per vaginam* in that the whole of the uterine cavity is exposed to inspection, and the disease may be thoroughly and safely dealt with.

DECIDUOMA MALIGNUM; SUPRAPUBIC HYSTEROTOMY; SUPRAVAGINAL HYSTERECTOMY;
RECOVERY

CASE LXVIII.—Patient, 32, complained of pain in left iliac region and blood-tinged leucorrhœa.

Six months previously illness began with moderately sharp pain in left iliac region, radiating up to chest and through to back. No vomiting. Constipated.

Since two months pain has been much more severe and more frequent. There is frequency of micturition and burning and soreness in bladder. Constant white vaginal discharge frequently tinged with blood. Has missed last two menses. Has five children living and well; has had two miscarriages.

Abdomen walls relaxed and flabby. Tenderness in left iliac region. Vaginal examination showed that cervix pointed upward and to right. Uterus extended to 4 Cm. above pubis, freely movable, not tender.

Cystoscopic examination revealed slight congestion of bladder and that its floor was pushed upward by some pressure from without (thus accounting for the frequency of micturition and the burning and soreness over bladder). Blood count: Hæmoglobin, 70; red blood-corpuscles, 3,340,000; white blood-corpuscles, 9850.

At operation with the patient in the Trendelenburg position through an incision in the lower right rectus the uterus was found pregnant, and was opened by an anterior incision in the midline. On removing the products of conception a friable, ulcerated area was seen on posterior wall. The uterus was removed by supravaginal hysterectomy. Closure.

Pathologic examination showed that the uterus measured 9 x 8 x 5 Cm. The endometrium was boggy, filling the entire cavity, and about .5 Cm. thick. Wall of uterus 2 Cm. thick and softer than normal. Fœtus 15 Cm. in length and shows genital tubercle without differentiation. Internal surface of placenta very friable. Microscopic diagnosis, deciduoma malignum.

When the pregnant uterus was encountered it was reasoned, from the fact of there being no extra-uterine cause of the pain, that it must

be intra-uterine, and that, therefore, hysterotomy was justifiable. Thus a malignant tumor in a very early stage was revealed by hysterotomy. Suppose the pregnancy had been terminated by artificially-induced abortion? The tumor would have been undoubtedly overlooked and left behind, speedily to terminate the patient's life.

Deciduoma malignum originates from the syncytial cells of the chorionic villi. The term chorion-epithelioma is preferable, because it indicates the origin of the tumor from the epithelial elements of the chorionic villi rather than from the decidua, but the former term is used here, since it is classified under that heading in the annual report of the German Hospital. The disease arises in portions of the chorionic villi which remain imbedded in the endometrium after the expulsion of the main products of gestation, and especially if the villi have undergone hydatidiform change. Thus it follows an abortion, a premature labor, or a labor at term. A remarkable feature connected with chorion-epithelioma is the discovery that certain intrathoracic teratomata and teratoid tumors of the testis contain tissue indistinguishable from that of chorion-epithelioma (Bland-Sutton). The eroding power of the cells enables them to penetrate the tissues and gain entrance to veins; fragments are deported by the blood stream to lodge in lungs, bones, and other viscera and grow into secondary deposits. The liver, spleen, kidneys, and intestines may thus be invaded, since, unlike most carcinomata, this variety is disseminated through the blood-vessels. The diagnosis is suspected at first by irregular, persistent bleeding following the termination of pregnancy, and later by the usual signs of uterine cancer. The value of hysterotomy as a diagnostic measure, and for this reason as an equally efficient therapeutic measure, could not be more forcibly illustrated than by this case.

This was the only case of chorion-epithelioma encountered during our five-year period.

PLACENTA PRÆVIA; SUPRAPUBIC HYSTEROTOMY; RECOVERY

CASE LXIX.—Patient, 31, complained of bleeding from vagina.

Four months previously menses appeared three weeks late and lasted for one month. Under treatment it stopped for two weeks, when profuse hemorrhage began, patient losing as much as one quart at a time. Bleeding has continued up to time of admission.

Since one month has had occasional cramps, worse on right side. These were sharp, but did not resemble labor pains. No nausea or vomiting.

Has one child, aged four years, living and well. Had the usual amenorrhœa of pregnancy at that time. Has had no miscarriages.

A tumor resembling a pregnant uterus extends up to navel, and is lodged mostly on the right side. Cervix dilated to size of index-finger. Active bleeding from uterus. Patient very weak. Blood count: Hæmoglobin, 62; red blood-corpuscles, 3,390,000; white blood-corpuscles, 7100.

At operation hysterotomy was performed as described in Case LXVII. On delivering fœtus the umbilical cord was found wrapped tightly about its neck. The placenta had a central attachment, and was degenerated. Closure of uterus and then of wound. A small myoma was excised from uterus, and a chronically diseased appendix removed.

The umbilical cord encircling the neck might have been a factor in detaching the placenta as the fœtus struggled for existence.

It was Dr. Deaver's privilege to be one of the first to perform hysterotomy for placenta prævia, which he considers an absolute indication for the operation. In central implantation, as in this case, in which the placenta widely overlaps the outlet of the uterus, it is more strongly indicated than in the marginal implantation, but the difficulty in most cases of determining accurately in advance the exact situation of the placenta should make one distrust dilatation of the os by bags. By this latter method hemorrhage may often be checked and delivery satisfactorily effected, but bag-dilatation has failed and resulted fatally from hemorrhage in the hands of even the most skilful obstetricians. There is always a feeling of insecurity when dealing with placenta prævia by this method. Even advocates of the bag dilatator feel great relief when the patient is out of danger. On the other hand, one may approach the operation of hysterotomy in this condition with the same assurance that he feels concerning cesarean section under other circumstances. Abnormal implantation of the placenta does not add to the gravity of hysterotomy. It can be performed in the same manner and with the same absolute control over hemorrhage as in any other abdominal operation on the uterus. Shock is less, and the liability to infection is certainly not greater. In the late cases, if operation be done at the proper season, the child also can be saved, which is not usually the case in delivery by any other method. Eight cases of placenta prævia have been treated by hysterotomy at the German Hospital without maternal mortality.

PYELITIS OF PREGNANCY; SUPRAPUBIC HYSTEROTOMY; RECOVERY

CASE LXX.—Patient, 18, complained of constant, dull ache, at times sharp, in right loin and across mid-abdomen.

Well until four days before admission, when, after exposure to a draught, pain commenced gradually in right loin and within a few hours radiated across mid-abdomen and back to loin. Nausea and vomiting at onset, but none since. Had chills and sweats several times.

Patient is five months pregnant; pale. The skin is hot and dry, the cheeks flushed, and the tongue coated, dry, and tremulous. Tenderness on palpating right kidney. Urine: Yellow, acid, 1025, very faint trace of albumen, no sugar, urea .9 per cent., granular casts, pus. Blood count: Hæmoglobin, 59; red blood-corpuscles, 3,490,000; white blood-corpuscles, 16,700.

At operation hysterotomy was performed as described in Case LXVII. The fœtus, enclosed in unbroken membranes, was enucleated. Closure of uterus. Removal of appendix. Closure of wound.

Simple pyelitis is not an indication for hysterotomy. Palliative measures or local treatment effect a cure in most instances. But when the general condition is alarming, as in this case, operation gives the most rapid and surest results. In five cases hysterotomy with emptying of the uterus was performed because of a severe renal infection that amounted to sepsis. In one case, actuated by conservatism, Dr. Deaver refused to empty the uterus, a decision which later he regretted, as the unfortunate woman in her debilitated condition contracted a severe puerperal infection, from which she died. When a septic focus exists in the body with consequent infection of the blood stream, there is grave danger of hæmatogenous infection of the uterus after childbirth. The circumstances of the patient must be considered among the indications for the termination of pregnancy under these conditions. If she can command good treatment and enjoy hygienic surroundings, every effort should be made to carry her through to term. But a patient of the poorer classes who has to look forward to some months of advancing pregnancy in a septic state that does not yield to such treatment as can be carried out and maintained is entitled to have her life considered the paramount issue.

Among twenty-five cases of hysterotomy performed since 1912 there was no mortality. Fifteen met the indications of the first class (see introductory remarks on suprapubic hysterotomy), and ten of the second. That is to say, sixty per cent. of the operations were undertaken with the well-defined idea that some early neoplastic process was present in the interior of the uterus, and forty per cent.

because of danger to life by reason of complications of pregnancy. Only three uteri were sacrificed, one each for carcinoma, chorio-epithelioma, and myoma associated with chronic metritis and endometritis. One eclamptic patient was cured and is again normally pregnant. In one case of contracted pelvis the operation was successful for mother and child. Five patients with partial separation of the placenta were relieved, and three with placenta prævia were snatched from imminent danger. In the remaining cases, while the operation was not life-saving, yet in its results it challenges any other form of treatment yet devised.

Russell states that suprapubic hysterotomy is of conspicuous service in cases of persistent uterine hemorrhage which is not controlled by any form of treatment, and in which bimanual palpation of the pelvic organs has given an absolutely negative diagnosis. It is destined, also, to be of great service in the early diagnosis of cancer of the fundus of the uterus. Not only may a percentage of early cancers be detected by hysterotomy, but in a more considerable percentage of cases in which cancer is reasonably believed to exist will the incision reveal the true cause of the bleeding in hyperplastic endometritis, polyps of the endometrium, or small submucous myomas.

The chief contra-indication to hysterotomy is the presence of intra-uterine infection, either demonstrated or strongly suspected. Under these circumstances the operation may be made extraperitoneal by stitching the parietal peritoneum to the uterus and opening in the enclosed circle. In delivering the child the upper portion of this enclosed circle may be torn through, thus exposing the peritoneal cavity to infection. This must be considered an argument against the extraperitoneal operation ("Hysterotomy," *Jour. A. M. A.*, 1912, lix, 90; *Ibid.*, 1914, lxiii, 292).

PROSTATECTOMY

In the removal of an enlarged prostate gland Dr. Deaver prefers the suprapubic to the perineal route for the following reasons: (1) The approach to the prostate is simple and practically bloodless. (2) The enucleation of adenomatous growths is accomplished with ease. (3) The working field is large and under perfect control. (4) The prostate is accessible and can be made more so by digital pressure

on its rectal surface, and without the danger of injury to the bladder from the use of tractors necessary in the perineal operation. (5) The muscular control of the bladder is not disturbed, since the internal sphincter may be avoided, and the compressor urethræ lies outside the line of cleavage. Incontinence is therefore less frequent following this technic. (6) Permanent fistulæ are less frequent after the suprapubic operation; in fact, they never occur if the urethra is bougied. (7) Stones can be removed more easily. (8) Sexual potency is maintained as frequently after the suprapubic operation as after the perineal, and the question of sterility is rarely of any consequence. (9) The mortality in properly selected cases is no greater, and the percentage of uncomplicated cures is larger.

HYPERTROPHY OF PROSTATE; SUPRAPUBIC PROSTATECTOMY; RECOVERY

CASE LXXI.—Diamond setter, 58, complained of frequency of urination.

Since a few months has had to get up at night to urinate as often as from one to two up to six to eight times. Has to be catheterized at times. Pain precedes but does not follow urination. Passed bloody urine twice. Constipated.

Rectal examination shows that prostate is large, smooth, and tender.

Cystoscopic examination shows that prostate is considerably enlarged intravesically, and that there is cystitis with numerous submucous hemorrhages. Indigo-carmin test yields no elimination from either side before fifteen minutes. After eighteen minutes a very faint color appears on the right side, but none from the left in twenty minutes. On the basis of this test the cystoscopist regards the patient as a poor operative risk.

Skiagram reveals no calculus. Urine: Yellow, acid, 1001, very faint trace of albumen, no sugar, urea .1 per cent. Blood count: Hæmoglobin, 84; red blood-corpuscles, 4,730,000; white blood-corpuscles, 6350.

At operation with the patient in the Trendelenburg position through an incision in the lower right rectus the prevesical space was entered by a clean stroke of the scalpel and the peritoneum pushed up. On opening the bladder the prostate was found greatly enlarged intravesically. A circular incision was made around the internal urinary orifice. Supported by a finger of one hand in the rectum, the ungloved index of the free hand entered the circular incision and, insinuating itself between the prostatic capsule and its sheath, it worked around the organ until the latter was free and could be removed. Prostatic bed irrigated with hot water to check what little bleeding there was. One rubber tube sutured into bladder, which was then closed up to the tube by a suture of iodine catgut that traversed the muscular but not the mucous coat. One piece of rubber dam placed in prevesical space. Closure of wound.

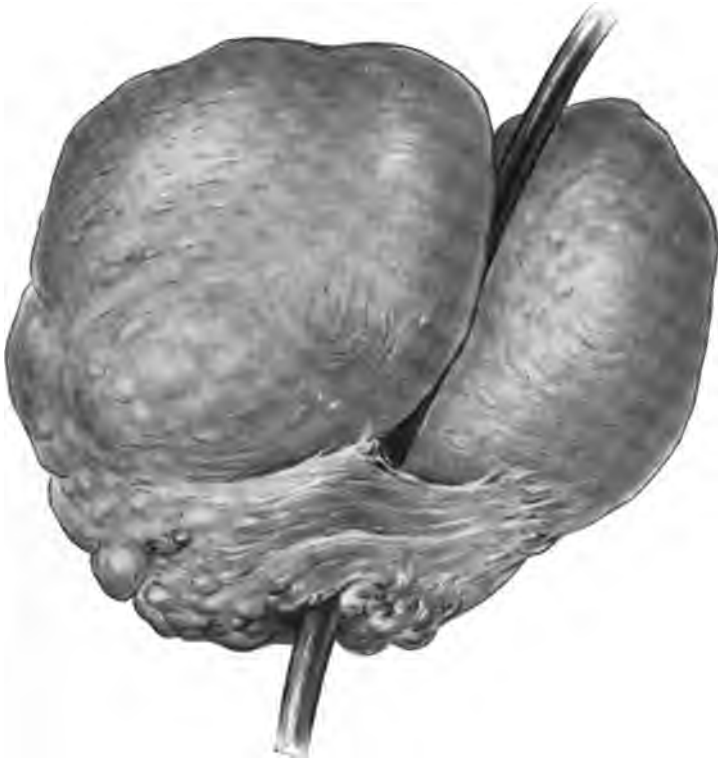
Pathologic examination of prostate showed that it measured 7 x 5 x 4.5 Cm., and that it had a moist, glistening surface. Microscopically there was benign hypertrophy with chronic inflammation.

It was noted that the elimination of indigo-carmin was so slow as to cause the cystoscopist to consider the patient a poor operative

risk. These various tests for renal function are not of much practical value. The operator was thus influenced to use stovaine intraspinal anaesthesia. In estimation of the function of the kidneys the twenty-four-hour amount and the specific gravity are of the utmost importance as indices, and the chemical and microscopic analyses less so. The secretory powers of the kidneys are the chief factors in the prevention of uræmia, the commonest cause of mortality. Water is the best diuretic, and may be given by mouth, or in saline by hypodermoclysis or proctoclysis. The cystoscope, however, is of great value in determining the most appropriate operative procedure. Other examinations that should always be made include rectal palpation, X-ray of the entire urinary tract, measurement of the urethral length, and estimation of the amount of residual urine and of the capacity of the bladder. Careful examination of the lungs is of prime importance also in influencing the decision between etherization and intraspinal anaesthetization.

To minimize the danger of infection of the prevesical tissues the bladder is exposed by a clean incision with the scalpel, rather than by scraping away or blunt dissection of the prevesical fat. The interior of the bladder and the projecting prostate may be directly inspected by simply placing two retractors laterally and one in the fundus of the bladder, the mucosa of which is held by a small piece of gauze. A circular incision is made through the mucosa about the vesical orifice of the urethra: this may be done with the scalpel, scissors, or, preferably, the sharpened finger nail. The purpose of the circular incision is to prevent the formation of a ragged flap of vesical mucosa, which may obstruct the outlet after operation. The finger finds a natural line of cleavage between the prostatic sheath and the true capsule, and shells the prostate out. While this is being done the surgeon supports the prostate by one or two fingers of the other hand placed in the rectum, which serve as a guide to prevent tearing into the rectum by the decapsulating finger after it has traversed the inferior layer of the aponeurosis of Denonvilliers. In cases of long-standing prostatitis and periprostatitis the fibrous partitions that normally pass between the sheath of the prostate and its capsule to surround the venous plexus in a mesh and bind the prostate in place may be much increased in strength, thus necessitating great force in tearing the prostate out of its enveloping sheath. Separation by blunt-

FIG. 9.



Hypertrophy of prostate, natural size. Catheter traverses urethra. (See Case LXXI.)

FIG. 10.



Microscopic appearance of carcinoma of prostate, from a patient aged 59. 1. Cancer cells. 2. Cancer nests. 3. Alveoli. 4. Concretion, lying within an alveolus.

pointed scissors facilitates this step. In some cases instead of removing the prostate as a whole it must be removed piecemeal. If the prostatic urethra can be preserved the chance of postoperative stricture is lessened, but in the majority of cases it is inseparable from the prostatic tumor. While the hemorrhage is rarely annoying, it is at times sufficiently free to become dangerous. It may usually be easily controlled by hot irrigations, but in the event of excessive bleeding the prostatic cavity must be packed with a strip of gauze. Preparatory to this step a purse-string suture of catgut is placed around the bladder margin of the prostatic bed and is tied tightly after the pack has been introduced. The free ends of the latter project through the incision in the abdominal wall. By this method the control of hemorrhage from this source is absolute. The drainage tube must be of large calibre, at least one-half inch in diameter, and supplied with lateral and terminal openings to lessen the danger of its obstruction by a fold of mucous membrane. It is introduced just a little way into the bladder so that drainage is not interfered with, and is so placed that siphonage of the *bas-fond* is proven perfect before the patient leaves the table. It is held in place by a catgut suture passed through the skin, the superficial fascia, the deep fascia, and the sheath of the rectus. Catheters *per urethram* do not aid materially in the drainage and are liable to provoke hemorrhage upon removal. Infection of the suprapubic space is guarded against by closing the lower end of the wound very loosely, and passing a wick of gauze or a piece of rubber dam down to the loose cellular tissue of the prevesical space. As the final step in the operation, the wall of the bladder is anchored to the rectus muscle with a suture of catgut so as to prevent the bladder prolapsing away from the tube and thus failing to drain properly. The incision, if large, is closed below, and the drainage tube and gauze from the bladder and prevesical space are brought out through the upper angle. Upon completion of the operation the patient is removed to bed and the suprapubic tube is connected with a rubber outlet tube running to a receptacle, which contains an antiseptic fluid, at the side of the bed. He is immediately given a subcutaneous injection of 500 to 1000 Cc. of normal saline solution, and the routine postoperative procedures are instituted.

Postoperative treatment ranks in importance with the preliminary preparation. Continuous irrigation of the bladder is avoided.

With a large suprapubic opening the bladder cannot fill with clots, and if a small amount of clotted blood forms it readily comes away, while long-continued irrigation is in some cases a trial to the patient and accomplishes no good. Careful nursing is essential, and female nurses understand better the kindly ministrations which mean so much to the comfort and *morale* of the patient. The most important post-operative considerations are the supply of water and the consequent free action of the kidneys. Rectal saline is begun as soon as the patient is quiet after the anæsthetic. Any sign of diminution of diuresis is met by repeated hypodermoclysis. Sparteine and caffeine hypodermatically are often given and seem to be of service. Digitalis and nitroglycerin may be given in cardiovascular weakness. Morphia is shunned, and sedatives in general are given sparingly and only upon the strongest indications. In three or four days, or as soon as the strength warrants, the patient is lifted out of bed into a chair and kept sitting until slight fatigue overtakes him. This should not be overdone, nor should it be omitted, as it stimulates markedly the circulation and the kidneys, and avoids the pronounced tendency to hypostatic congestion and basal bronchopneumonia, common in these elderly patients. The gauze in the prostatic bed should be allowed to remain for four or five days, to avoid the risk of secondary hemorrhage. The drainage tube and the wick in the suprapubic space are removed at the end of from three to five days. A smaller tube may be substituted. After removal of the tube the urine drains freely into gauze pads, while every effort is made to keep the patient as clean as possible. For this purpose one of the various cups used to keep the patient's body dry while the fistula is healing may be desirable. A sound is passed at the expiration of about eight days after operation, and at least once a week thereafter until healing is complete, in order to guard against postoperative stricture of the urethra. The wound heals at times very rapidly, and as a rule patients should be well in from four to six weeks.

Permanent fistula after the suprapubic operation is practically unknown. Postoperative hemorrhage is exceedingly rare, but if it occur the treatment consists first in hot irrigations of the bladder and rest for the patient. At times the use of ice-bags over the hypogastrium seems to have a hæmostatic action, and injections of human blood-serum are often efficacious. Should these simple measures

fail to stop the bleeding or to reduce it to a slight oozing, the bladder must be reopened and the prostatic bed firmly packed again. Sepsis is a rare sequel, and it is well to remember that an irregular temperature is often seen in cases in which gauze packing has been used, but subsides immediately upon removal of the latter. Sepsis from pelvic cellulitis is usually a fatal complication, but its relief is to be attempted by appropriate drainage. As a routine measure, the bladder is washed out daily with permanganate of potash or other weak antiseptic solution. The patient is given urotropine, and encouraged to drink large quantities of water. Uræmia and suppression of urine occur at times despite careful selection of cases and judicious treatment both before and after operation. Hiccoughing and nausea are the danger signals. Their occurrence demands frequent gastric lavage, followed by the introduction of large doses of magnesium sulphate solution until the bowels are freely open. Absolutely nothing is to be given by mouth. Hypodermoclysis, 1000 Cc. of normal salt solution, is given every six or eight hours. Continuous proctoclysis is instituted, and caffeine and sparteine given hypodermatically, with or without nitroglycerin, depending upon the tension of the pulse. The condition is sometimes fatal, but energetic treatment along these lines sometimes saves an apparently hopeless case.

Perineal prostatectomy is the method of choice in (1) cases of carcinoma in which lines of cleavage have been obliterated; (2) tuberculosis of the prostate; (3) the small, sclerotic prostates of chronic prostatitis or fibrous hypertrophy. In any of these groups prostatectomy should be performed only upon the strongest indications. Young's technic is used for this route.

Carcinoma of the prostate is found in approximately ten per cent. of prostatic enlargements. Every benign prostatic hypertrophy, especially if it be the cause of clinical symptoms, harbors the potentiality of cancer, and, in the absence of positive contra-indications, advice should be exactly the same as that given in cases of tumors of the breast, namely, excision. In early cancer there is an absence of distinguishing signs owing to the rich lymphatic supply which carries the malignancy beyond the limits of radical excision, long before a nodule is appreciable to rectal palpation. In a prostatic cancer arising from a preëxistent adenoma the signs suggestive of malignancy are often wanting, and one may remove a large, soft, easily enucleated

tumor, secure in his clinical judgment of its benignancy, only to find malignant changes in the routine study of microscopic sections. A nodular tumor of extreme and often irregular density firmly fixed to adjacent structures, especially to the rectal wall, and with continuous referred pains spreading upward between the seminal vesicles, undoubtedly indicates carcinoma, and assures one of the hopelessness of operative cure. In operable cases of cancer, when there is marked urinary obstruction, a suprapubic fistula may be established by way of palliation. The most reliable diagnostic sign in prostatic carcinoma is failure of the rectal wall freely to slide over the gland ("Enlargement of the Prostate," 1905, and later papers).

During the five-year period eighty-two hypertrophied prostates were removed with fifteen deaths, and ten carcinomatous with six deaths.



John D. Dooney

ANAL FISSURE — INTERNAL HEMORRHOIDS: COMBINED INTERNAL AND EXTERNAL HEMORRHOIDS

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THERE are two patients to be brought before the clinic this morning for operation. The pathology of each is somewhat similar in character, in that the anorectal canal is involved, yet there are some distinctive differences which will be explained during examination and operation. Both patients have been carefully prepared for operation in accordance with the usual custom in this hospital, which will be outlined at the close of our lecture.

CASE I.—C. K., male, white, aged twenty-five years. Family history negative. Personal history: General health good; a moderate user of alcohol; does not smoke or chew tobacco. Had ordinary diseases of childhood; no other illness; no injuries. Has been complaining one week of burning and pain in his rectum.

We have no history of hemorrhage, protrusion, itching, or rectal discharge, the only symptoms being burning and pain. That one word "burning" immediately suggests the possibility of a raw lesion within the anorectal canal of recent development. Ordinarily a burning sensation within the rectum is not a symptom of long-standing rectal disease or ulceration. In this case the patient claims the trouble began only one week ago. What would be most likely to produce a burning sensation within the anorectal canal? A fissure: but would the history of pain harmonize with this diagnosis,—that is, does a fissure produce pain? Yes, a great deal of pain of a sharp, cutting, burning character.

An accurate history of the onset of symptoms is important. How and when did the burning and pain begin,—that is, did these manifestations accompany the passage of hardened feces? If anorectal

fissure exist, most likely it was produced in this way, or by slight abrasion from a foreign body incorporated in the hardened faecal mass. For instance, the patient may have swallowed a large piece of bone which cut the mucocutaneous junction during defecation. In similar manner a small piece of bone with sharp edge projecting from hardened faeces might cause a fissure.

Why does a cut at the mucocutaneous junction continue to cause pain: why does it not heal as readily as similar wounds in other parts of the body? One reason is that the relaxation and contraction of the sphincter muscle prevent healing; another is frequent contact with infective material. Faeces containing colon bacilli and perhaps other infective organisms pass over the fissure, which is necessarily open at the time, the anal canal being dilated by the passage of faeces, and infection occurs. This, in conjunction with contraction and relaxation of the sphincter, produces pain and prevents healing of the fissure.

Pain from anal fissure is generally sufficient to cause the patient to seek medical assistance; in fact, oftentimes a person thus suffering complains more of pain than one with an aggravated case of hemorrhoids or extensive anorectal fistula, and in consequence not uncommonly the patient believes his condition is extremely serious.

The question is frequently asked: Provided the fissure be simple and constitute the entire anorectal trouble, is a general anaesthetic required, and may an appropriate operation be safely performed under local anaesthesia? Much depends upon the lesion present. If the fissure be of recent origin and uncomplicated, it may be successfully treated without the administration of a general anaesthetic. If, however, the fissure be of long standing, or deep enough to involve the fibres of the sphincter muscle, a general anaesthetic is usually to be preferred. Under local anaesthesia, at least according to the older ideas, it is hardly possible sufficiently to divulse the sphincter muscle. Of course, it is well recognized that in the treatment of anorectal fissure it is necessary completely to divulse the sphincter. By divulsing I do not mean that the fibres of the muscle should be torn or the attachments separated, but to stretch the muscle to its limit. It is necessary to place the sphincter at complete rest for several days in order to prevent contraction and relaxation. If the fissure do not involve the sphincter muscle, a favorable result may be expected from

partial dilatation, such as may be practised without the administration of a general anæsthetic, followed by proper local applications. Nitrate of silver solution carefully applied often causes healing of uncomplicated fissures. However, extensive fissure complicating other rectal or anal lesions cannot be properly treated under local anæsthesia. It is quite probable the patient before us has other rectal lesions in addition to the fissure.

Inspection reveals a tag of skin in the left posterior anal quadrant; there is also external evidence of existing hemorrhoids. The skin surrounding the anus exhibits folds which suggest the possibility of proctitis or other inflammatory lesion. It is noted also that, following withdrawal of the finger, blood escapes from the anus. This may be the result of tension and friction upon the mucosa from introduction of the finger, or an inflammatory or ulcerative lesion may exist, which will be more fully determined presently.

The small tag of skin mentioned is not really a hemorrhoid, although many of the older authors considered it as a so-called "sentinel pile," which was supposed to indicate the presence of a fissure higher in the canal. Most frequently it represents one of Morgagni's crypts which has been lacerated by the passage of a foreign body or hardened feces, and it is the injury to this crypt which originates the fissure.

Another important point is that when a fissure is permitted to exist for an extended period it gradually becomes deeper, finally constituting what is termed an irritable ulcer of the sphincter muscle. When a fissure is no longer simply a crack at the mucocutaneous junction it should have a more descriptive designation; thus it is called an irritable ulcer after it has extended into the muscular fibres of the sphincter and has become more extensively infected.

The patient being fully anæsthetized, we proceed with the examination. A characteristic blueness is noted upon all sides of the anus, which indicates stagnation of the blood in the tissues, and very likely internal hemorrhoids will be revealed. As was suspected, there is a small fissure in the posterior anal line which has evidently been the cause of the pain. The skin tag is not a so-called "sentinel pile," as external examination suggested. The sphincter is already well dilated from previous rectal irrigation, and indicates that anæsthesia is complete. When anæsthesia is insufficient, the sphincter contracts upon the examining finger.

The sphincter having been more thoroughly divulsed with the fingers, several medium-sized internal hemorrhoids are brought into view. The anal canal thus being widely open, the hemorrhoidal tumors are readily everted. Where the hemorrhoids are so situated that the introduction of forceps into the anal canal becomes necessary, permit me again to remind you that the forceps should not be opened until inserted; introduce the forceps closed, then open, and after grasping the tumor lock the forceps, thus affording a firm hold upon the tissue to be removed. With scissors curved on the flat, begin at the mucocutaneous junction upon one side, and dissect entirely around the hemorrhoid to the mucocutaneous junction upon the other. The forefinger of the left hand is placed upon the upper margin of the hemorrhoid, and by turning with the attached forceps all hemorrhoidal tissue can be readily seen. Dissection is continued until only the mucous membrane and the blood-vessels intervene between the finger and the point of the scissors, a heavy ligature being applied to the small remaining pedicle.

Some one has asked what ligature material is employed. It is a mixture of cotton and linen. The cotton makes it absorbent, and a sufficient quantity of linen is used to give it the desired strength. The pedicle, composed of the mucous membrane and blood-vessels, is ligated as tightly as possible with this heavy ligature. All the hemorrhoids are treated in the same manner, forceps being allowed to remain attached until the last hemorrhoid has been ligated, then, after insertion of the anal dressing tube, the tumors are excised, leaving only sufficient stump to retain the ligature.

While this patient gives the history of rectal pain existing only one week, operation demonstrates that the pathology could not possibly have developed within that time. Doubtless he has suffered several years, and perhaps did not remember this when giving the history, or he may have forgotten the earlier manifestations; but when the fissure began to cause acute pain he came to the hospital for treatment. The pain, being acute and persistent, was to him an important matter, whereas the earlier and less annoying manifestations were forgotten. It is noteworthy that pain which is not continuous will be forgotten when relief has been secured. The pain produced by fissure persists until relieved by proper treatment, and therefore, after waiting a reasonable time, the patient seeks medical attention.

All the hemorrhoids having been ligated, the anal dressing tube

will be inserted. It is important that this be introduced before excising the ligated hemorrhoidal tumors. If one were to excise the tumors first and then attempt to insert the tube, the ligatures might be disarranged and the stumps pushed upward into the rectum, thus defeating one of the primary purposes for which it is utilized. Note the healthy rectal mucosa above the ligatures, all the diseased tissue having been removed. When the tube is inserted the sphincter muscle closes upon the smaller upper portion that is provided with a flange, and any discharge (blood, mucus, pus, fæces) gravitates outside the anus, contamination of the wound being prevented. The tube is maintained in proper position by placing narrow strips of gauze between the perineal tissues and the outer flange; this brings the upper flange downward upon the sphincter muscle and maintains it there. The gauze wrapped around the tube as described effectually covers the wound. There will be just enough capillary oozing to cause adhesion of the gauze to the denuded surfaces, thus practically sealing the wound and furnishing an additional protection against infection from the discharges. A pad of gauze placed over the outer surface keeps the wound dry and clean, and also prevents anything coming in contact therewith. The dressings are held in place by a perineal or ordinary "T" bandage, the former being preferred. The bandage is tied tightly around the patient's waist just above the hips (if placed too high it slips downward and becomes loose); then it is brought downward on one side, over the perineum, and upward on the other side, under the waistband, then back on the opposite side, where it is fastened.

The patient is placed in bed, and so soon as he awakes a hypodermatic injection of $\frac{1}{4}$ grain morphine with $\frac{1}{150}$ grain of atropine will be administered, provided no atropine was given previous to the anæsthetic. The purpose of these drugs is to secure quietude and prevent unnecessary pain. If this were the only indication, morphine might be omitted; but it is necessary for another reason, namely, to prevent bowel movement earlier than desired. The bowels should not be permitted to move for at least four days. With the anal tube applied as described, evacuation may be safely postponed for a week if it seem desirable. Any gas which may accumulate is immediately discharged through the tube, and additional room is thus provided for the fæces. When evacuation is desired, give the patient a large dose of castor oil; by a large dose is meant at least two or even three

tablespoonfuls. Calomel, followed by salines, or two or three compound cathartic pills, may be employed if preferred.

In twenty-four hours, when the outer gauze pad is removed, there will be found thereon a thimbleful of mucus. Attention is called to the fact that this accumulation of mucus contains colon bacilli and other organisms from the bowel which might have caused infection of the wound were it not for the protection afforded by the anal tube. A straight tube, or one without the double flange, does not afford protection, because there is nothing to prevent infective material gravitating downward around the sides of the tube. Rarely does infection occur when the dressing tube described is properly applied, and healing of sutured anorectal wounds by first intention is the rule. Without such protection the wound may become infected, and proper healing does not occur. The anal tube may be safely left *in situ* so long as seems necessary.

The next patient is now ready for operation, anæsthesia being sufficiently profound. Several large hemorrhoids are noted protruding from the anus, and after the sphincter muscle is thoroughly divulsed others will be found within the anorectal canal.

CASE II.—O. S., male, white, aged twenty-nine years. Father, mother, two brothers, and two sisters living and in good health. General health of patient always good; uses alcohol moderately; had ordinary diseases of childhood; no other serious illness prior to present trouble. Date of onset probably two years ago; history of constipation, rectal hemorrhage, and pain.

The pathology in this case differs from the one just operated upon in that the inflammatory portion of the hemorrhoidal tissue extends considerably higher in the anorectal canal, and also in the fact that a greater number of external hemorrhoids is present. In excising internal hemorrhoids it is important that the tissue be ligated sufficiently high in the anorectal canal to include all the inflammatory zone, otherwise hemorrhage would continue, and recurrence follow.

As in the other case, after application of forceps to the hemorrhoidal tumors, dissection with scissors begins at the mucocutaneous junction upon one side and extends to the mucocutaneous junction of the opposite side, and is of sufficient depth so that the ligature includes only the mucous membrane and the blood-vessels. The old-time ligature operation, still employed by certain surgeons, in which a groove is made through the skin only and the ligature placed therein, the pedicle thus being very large, is obsolete. It is not surprising that

patients have suffered intensely following such operations. The purposes of the ligature are to (1) prevent hemorrhage, and (2) obviate upward retraction of the mucous membrane. The mucous membrane might retract an inch or more, leaving an extensive raw surface (this is one of the objections of the clamp and cautery operation); the large vessels would bleed, and hemorrhage might be sufficient to cause death. The authors of the older text-books suggested that large hemorrhoids be transfixed by making an incision merely through the skin, passing a needle threaded with a double ligature through the centre of the hemorrhoid, removing the needle, and then ligating the hemorrhoidal tissue in two sections, the longer ligature encircling the hemorrhoid, which is then excised, the large stump being left to ulcerate. Why such an operation was ever advocated and practised is difficult of understanding.

With the left forefinger just above the upper margin of the hemorrhoid, dissection is made with scissors as already described. Care must be exercised not to turn the scissors downward in making the dissection, lest the cut extend above the hemorrhoid; with the digit above the upper margin as described, direct the scissors upward toward the finger, and by slight pressure the point of the scissors may be felt as dissection is carried upward; then by everting the hemorrhoid from the anus dissection may be continued until only a small pedicle remains. Sometimes, in our eagerness to reduce the size of the pedicle and thus minimize the pain which the patient might otherwise suffer, one of the blood-vessels may be severed. Suppose this accident happen: it is immediately under the eye, the bleeding vessel is clamped with forceps and included in the ligature, or may be ligated separately if preferred. No harm can result from such an accident, but it seldom happens if the finger be placed above the hemorrhoid as suggested.

Owing to the large size of the hemorrhoids in this case, and the extensive dissection required to reduce the pedicle to the proper size, there is considerable oozing after the tumors are excised. However, this is merely a capillary oozing which is readily controlled by pressure of the anal dressing tube with gauze applied as already described. A gauze pad is then placed over the wound, and is held in position by the perineal bandage. As in the other case, morphine and atropine will be administered hypodermatically so soon as the patient is awake.

During the operations just completed, no water nor feces appeared

to contaminate the operative areas. The wounds were just as clean as if situated elsewhere in the body. Contrary to the opinion expressed by many of the older authors, infection of anorectal wounds need not necessarily occur, provided the patient is properly prepared before operation is undertaken. However, in many instances infection has already occurred, and the best that can be done is to limit its farther extension. In this clinic all patients are prepared for anorectal operations according to the following plan:

A purgative is administered on the second night preceding the operation. If the patient does not reach the hospital in time for a purgative at least thirty-six hours before the time of operation, then omit the purgative and trust to enemata to cleanse the colon and rectum. When there is sufficient time, give the purgative the second night before at late bedtime, so the patient will not be disturbed until the early morning hours. Free evacuation will occur the following forenoon, and on the afternoon of the same day a large soapsuds enema is given. This should be done with the patient in the knee-chest position, so the fluid will fill the entire colon. He is instructed to remain in that position a few minutes, gradually assuming the recumbent posture. Another soapsuds enema is given the same night, and is also allowed freely to flush the bowel. On the morning of the operation, three hours before the appointed time, a third soapsuds enema is given, the patient being instructed to void all the fluid, thus removing any residual feces and mucus. Sufficient time will then have elapsed so that any fluid retained within the rectal folds will be absorbed, and the anorectal canal will be clean and dry during the operation.

It is as great a mistake to give an enema half an hour before the operation as it is to administer a purgative the night before, because, even though the patient might try to pass all the fluid, some, nevertheless, will be retained within the rectal folds. Under these circumstances, when the patient is placed upon the table and the sphincter muscle divulsed, more or less fluid will appear; when this is removed and the operation commenced, more fluid will be encountered; and as this fluid is not necessarily sterile, infection of the wound is almost certain to occur. With these precautions, operations upon the rectum may approximate in degree of asepsis more nearly to those performed upon other parts of the body.

NOTES ON SOME TOPICS OF MODERN SURGICAL INTEREST

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I

THE TREATMENT OF ACUTE POSTOPERATIVE GASTRIC DILATATION

THE only difficulty in the treatment of acute postoperative dilatation of the stomach lies in the diagnosis, which is not always an easy matter, but when once made the patient is saved if the treatment is begun without delay.

The application of ice-bags to the epigastrium may be useful in very mild cases, but the only rational treatment is to empty the stomach, this to be followed by irrigation of the organ with tepid, sterile water, to which a small amount of soda bicarbonate may be added with advantage. The stomach tube should be of the simplest pattern, and the physical condition of the patient, no matter how precarious, is never a contra-indication for its use. Complete evacuation of the contents of the organ should always be done within the shortest time after the diagnosis has been made. Some surgeons have considered that the fatigue, collapse, and shock accompanying this pathologic entity are contra-indications to the use of the stomach tube, but many cases show that gastric lavage has been done *in extremis*, and there is no record to indicate that any serious shock or syncope resulted.

A prophylactic treatment for the shock, if present, may first be given, such as injections of physiologic salt solution and camphor. There is, to my mind, only one contra-indication to gastric lavage, and that is a very unusual complication, namely, hæmatemesis produced by the stomach tube.

If the patient be not too depressed, it is better to have him supported by pillows or bed-rest in the semi-sitting posture, but should this be impossible for any reason, the tube can very well be introduced

with the patient lying quite flat on his back. Esophageal spasm may very likely occur, but this is readily overcome with a little patience and is not apt to recur subsequently, because the patient soon realizes such intense relief from the treatment that he often requests of his own accord to have it frequently repeated.

When the tube reaches the gastric cavity gas will usually escape, after which the bile-stained fluid gastric contents come away. The tube should be gently pushed down until either gas or liquid comes away through the tube. The introduction of a small quantity of water will often be required to effect proper siphonage. When the gastric sac has been emptied, it is usually well to irrigate the organ until the return flow is clear, because it is absolutely essential to remove by this means the toxic products from the organism. It is also not bad practice to introduce about 200 Cc. of milk just before withdrawing the tube in order to revive the gastric contractility.

The opinion appears to be unanimous that the results obtained are excellent. The patients seem to undergo a real renaissance, the vomiting or efforts at vomiting disappear, while the pulse and general physical condition rapidly improve. The gastric evacuation and flushing must be repeated as often as the particular case requires, sometimes every two or three hours, at others once or twice in twenty-four hours.

In 1895, Schnitzler proposed placing the patient on the ventral aspect, and the good effects of other positions have since been in turn proclaimed, such as the genu-pectoral, Trendelenburg's position, the left lateral and right lateral decubitus, etc. These various positions have mostly a German origin, and their originators had in mind the theory of mechanical obstruction by mesenteric strangulation, with imprisonment of the small intestine within the pelvis. However, the mechanism is of little import, but the effects of position are certainly immediate. I would here point out that in cases of difficult diagnosis, if the patient obtain relief from the ventral or genu-pectoral positions, one may be practically certain that acute gastric dilatation is present or is at least an element in the case should there be any doubt as to the presence of a septic process going on within the abdominal cavity.

But the genu-pectoral position is not long tolerated, and placing the patient flat on the belly is far better, since the result is the

same. Take two pillows and place one under the thorax, the other under the forehead for support. Patients in the postoperative period or during the puerperium support this position with comfort and this should be maintained so long as circumstances require, this usually being from forty minutes to an hour at a time. Then, after resting for a while, it should be resumed until all probability of a return of the dilatation is out of the question.

More recently, Mercadé has proposed a new means of removing the mesenteric obstruction, which is also very advantageous, inasmuch as it does not necessitate moving the patient. This is merely raising the bed on chairs so that it forms an angle of from 25 to 45 degrees with the floor, and this position should be maintained for some thirty-six hours, while the gastric lavage is done with the patient in this position.

It is quite needless to speak further on this simple, yet life-saving, measure, but I would point out that it is erroneous to believe that position alone should be resorted to in the treatment of acute gastrectasis. Emptying the gastric contents, followed by flushing out of the gastric cavity, must be employed as well, for the reasons already mentioned. Some surgeons have advised or performed surgical interference, but the results obtained have been no better than those where gastric lavage and the ventral position have been used.

Theoretically, gastro-enterostomy might seem indicated, but these patients are in a very low degree of vitality, and few could withstand the shock resulting from the operation.

Drainage of the gastric cavity by gastrostomy has been advised and performed in four cases that I know of, with three successful results. It can be done with spinal anæsthesia, and being a shorter and less complicated operation than gastro-enterostomy, there is much less operative shock. But, even here, this operation should never be resorted to unless the simpler means have utterly failed.

General treatment of the patient is not to be ignored. For evident reasons, medication by mouth is out of the question, so that hypodermic administration imposes itself. Caffeine is to be rejected on account of the secondary depressive effect it always produces. Sparteine, strychnine, and, above all, camphorated oil at the dose of from 40 to 60 Cc. in twenty-four hours, should be preferred.

Subcutaneous injections of physiologic serum in sufficient quan-

tity to compensate the loss of liquid due to the vomiting are to be frequently given, while steepage always has its place. Feeding is impossible, but the acute accidents do not last long enough to endanger the patient's life from inanition if proper treatment is at once directed against this pathologic entity so soon as the diagnosis is made.

II

THE SYMPTOMATOLOGY OF BILOCULAR STOMACH

No matter what may be the etiologic factor of bilocular stomach, this pathologic condition usually presents a very serious prognosis. The digestive disturbances increase in intensity and tend towards cachexia, unless an ulcerative process with perforation hasten the fatal outcome. Besides the serious types of stricture, there are other cases in which the stricture is not suspected because the evolution is silent without giving rise to serious symptoms. It may also happen that gastric perforation suddenly occurs without any prodromes in a stomach in which biloculation had not been previously detected. Consequently, it is of great import to detect this condition and, therefore, a few remarks on the symptomatology of bilocular stomach may not be out of place, this being followed by a description of the best means of making a correct diagnosis.

The functional disturbances generally draw the patient's attention, but are not sufficient in themselves for the surgeon to form an opinion as to the nature of the trouble. There is usually some pain complained of, which is tenacious and comes on after eating. Rest and appropriate feeding do not always calm the pain, but as this symptom may occur in any case of gastric ulcer no particular pathognomonic value should be given it.

Vomiting, likewise, does not relieve the pain. The symptom vomiting may be present, but is far from being a constant one according to my experience, and often these patients will provoke it of their own accord in order to obtain relief, just as in an ordinary case of gastric ulcer. When the vomiting is spontaneous it may occur almost any time according to the degree of the stricture, as well as the respective importance of the gastric pouches. When the stricture is narrow, the vomiting takes place shortly after the ingestion of food, but when it is of large calibre and the pyloric pouch vast, it arises only once or

twice in twenty-four hours. Consequently, this symptom has no particular diagnostic value, because it may resemble that encountered in gastric ulcer or pyloric stenosis.

The physical signs, although perhaps somewhat more precise, have, in reality, only a relative value. By inspection, Eichorst has noted a deep retraction over the greater curve of the stomach, but I am not aware that anyone else has observed this phenomenon. Lyon has described a more interesting symptom, namely, an intermittent hardening located at the left portion of the stomach. This sign puts in evidence the efforts of the stomach to force the contents through the mediogastric stricture, but it has been met with but seldom.

Percussion with auscultation gives rise to the characteristic splashing sound of gastric retention or to the passage of gas from one pouch to the other.

In pyloric stenosis, just as in bilocular stomach, the stomach tube may withdraw in the morning, with the patient fasting, small bits of food taken the evening before. However, the tube which is stopped from further onward progress by the stricture, empties the upper pouch and after apparently emptying the stomach still by succussion the characteristic "glou-glou" sound is heard. This would indicate the stomach has only been partially emptied, and under the circumstances the diagnosis of bilocular stomach at once comes to the mind. This is the symptom known as *ectasia paradoxa ventriculi*. Irrigation of the stomach has occasionally led to a diagnosis from the fact that the return fluid was much less in amount than the quantity taken by mouth.

Insufflation furnishes more precise indications. In some cases a communication between the two pouches takes place easily and they appear under the abdominal wall like two rounded tumefactions separated by a sulcus; in others, the stricture becomes accentuated by the tension which exists in the upper pouch and this appears alone in the left hypochondrium, while by percussion the lower limit of the stomach is outlined farther down. Let me say that this method must be undertaken with much prudence, particularly so because ulceration of the gastric walls may exist.

From what has been said of the symptomatology of bilocular stomach, it is clear that this affection offers numerous symptoms, but they are generally without precise value and inconstant, so that before

the introduction of radioscopy the clinical diagnosis of bilocular stomach was rarely made.

Out of a total of thirty-nine collected cases, the diagnosis of pyloric stenosis was made in seven, in four of which gastric ulcer was supposed to exist as well; four times malignant tumor was diagnosed, in one with pyloric stenosis and once a malignant growth developing on an ulcer; six times gastric ulcer; six times dilatation of the stomach; six times some gastric affection due to alcohol, etc.; and in nine cases only was the diagnosis of bilocular stomach made. If to these cases we add the "medical cases" in which the correct diagnosis was not made, we come to find that it was made only about once in twenty cases. These figures I do not believe to be exaggerated, because in those instances in which the clinical diagnosis is not consigned one almost invariably notices that there was gastric pain complained of over a period varying from some months to several years, hæmatemesis of long standing, and frequent vomiting, which naturally presuppose that the diagnosis of gastric ulcer was made. Of course, this means only a relative mistake, because bilocular stomach is almost always complicated by ulcer.

The technic of radioscopy is simple. All that is necessary is to stand the subject behind a fluorescent screen and then have him swallow a glass of gum solution containing bismuth carbonate in suspension, or some food in which is mixed from twenty to thirty grammes of carbonate of bismuth. A simple way is to give a bismuth cream, which is composed of aromatic cream, 150 grammes, in which twenty or thirty grammes of bismuth carbonate have been triturated. Now, what is important to know is that the shadow is not the same when the cream of bismuth or milk of bismuth is employed, and so I shall contrast the results obtained with the different methods.

With milk of bismuth, the shadow has a distinct bilocular shape and both gastric pouches are distinctly seen, separated by the strictured portion. In order to bring out the stricture distinctly, the abdominal pressure must not be allowed to force the liquid from the lower pouch into the upper.

The shadows obtained with the bismuth cream are quite different.

- (1) A fundus is formed in front and to the left of the obstacle;
- (2) the external border of the greater curve presents deep undulations, corresponding to the peristaltic contractions resulting from the efforts

made by the stomach to force the stricture, and this phenomenon may be seen to extend up under the diaphragm; (3) the lower opening of the upper pouch into the lower is always seated to the right and a little above the lower part of the fundus.

A few words now as to the differential diagnosis of bilocular stomach from the radiosopic viewpoint, because some stomachs give a shadow resembling an hourglass, although the organ is not bilocular. When the case is one of mediogastric spasm due to ulcer, the cream collects in the greater curvature, above the point of spasm, and a kind of irregular funnel is formed whose walls project to the left of the shadow; the fundus never exists and the opening connecting the two portions of the organ is always below, in the prolongation of the funnel.

Atonic dilatation gives a bilocular shadow, but I mention it here merely as a curiosity, as it is quite impossible to mistake it for a bilocular stomach. It well demonstrates the difference which should exist in radioscopy between the terms bilocular stomach and hour-glass stomach.

The value of radiosopic examination is easy to demonstrate: (1) It does not tire the patient; (2) it shows very well what is going on in the stomach, and (3) by the results obtained it confirms and justifies its great value from the standpoint of the diagnosis. The only reproach that can be made to it is its too great sensitiveness. For example, with a nervous patient examined in the erect position, the slightest stricture becomes accentuated on account of the concomitant spasm. Therefore, it will sometimes be necessary to avoid these spasms if one wishes to estimate the degree of stricture. Bismuth milk is not prone to give rise to spasm and, therefore, is to be preferred in nervous patients.

When one sees the lower pouch fill first, it is a proof that the stenosis is moderate, but when the bismuth milk flows slowly and with difficulty from the upper to the lower pouch, particularly when this takes one or several hours, the stenosis is very tight. The presence of abnormal peristaltic waves is requisite for the diagnosis of biloculation. With these reservations, which by no means limit the pathognomonic value of the signs given by radioscopy, it may be said that it is an excellent means of detecting bilocular stomach, providing one take the accompanying symptoms into consideration.

III

THE INDICATIONS FOR VESICULECTOMY IN TUBERCULOSIS OF THE
GENITAL ORGANS

In cases of genital tuberculosis, it is frequently a delicate matter to decide whether medical or surgical treatment is to be accepted. For some time past, the profession has been rather in favor of operation in these cases, but a healthy change in ideas has of late taken place and conservative treatment is gaining ground, I am glad to say. The literature teems with brilliant articles and *mémoires* on the surgical treatment of tuberculosis of the genital organs in the male, and yet, when all is said and done, the results are not famous. It is difficult to form an exact idea of the ultimate results of these interferences, and many patients are discharged greatly improved in health, but what becomes of them later? Does the tuberculous process extend to other portions of the genital apparatus or does it develop in the lungs?

It is too common to consider as cured a patient who does not return for further treatment, and, nevertheless, there are recurrences, but the patient is afraid of more operating and prefers to support indolent lesions or even the great inconveniences resulting from suppurating fistulæ. For all these reasons and, perhaps, many more, it is most difficult to form a correct idea of the ultimate outcome of these cases and, at the same time, explains the differences of opinion relative to the proper treatment to employ.

Primary or isolated tuberculosis of the epididymis, which up to within a very short time was considered frequent, has become an exception and almost always exists along with lesions in other portions of the genital tract or the urinary system. The urine is very frequently purulent, and out of a total of one hundred and four cases from the records of the Massachusetts General Hospital, my friend, Dr. J. Dellinger Barney, found that thirty-nine contained pus in the urine, while out of eight urines inoculated in the guinea-pig, seven showed tuberculosis.

It is clear, therefore, that an operation limited to the genital apparatus will not remove the entire trouble, and this would seem to indicate a conservative treatment. The principal reasons put forward against removal of the seminal vesicles are, first of all, the indolence of the lesions. It is evident that unless one be dealing with extensive

and advanced tuberculous lesions and neglect to make a careful digital examination *per rectum*, the lesions seated in the seminal vesicles will evidently be overlooked. Usually there are no functional symptoms indicating their presence unless the vesicles be so large that they press upon the rectum and cause disturbances in defecation.

A much more important argument in support of non-interference is the regression of the process in a goodly number of deep-seated tuberculoses, when the tuberculous testicles have been cured or removed. This retrogression has been observed by many competent clinicians and, in one case related by Reclus, a large prostate on the point of suppuration became completely atrophic after castration had been done.

All surgeons have met with similar cases, but this regression cannot always be counted upon; and, in two instances, I have been obliged to do vesiculectomy once in six months, and, in another, thirteen months after the testicle had been removed.

For many surgeons the generalization met with in some cases after operation justifies conservative treatment, tuberculous meningitis being, perhaps, the most common type. Others die from lung lesions. Roughly speaking, generalization after operations occurs in about 12 per cent. of the cases, which is about the same result observed in operations for tuberculous lesions elsewhere.

Another, and not the least important, reason for attempting vesiculectomy is the considerable difficulty in reaching the vesicle, as well as the numerous complications that this operation may cause, and, from personal experience, I can say without hesitation that it is one of the most difficult technics in the whole domain of surgery.

Rupture of the vas deferens, urinary fistulæ so long to heal, the possibility of injury to the ureter, when taken into consideration, offer little attraction or pleasure to the operator, no matter how competent. For these reasons many surgeons prefer not to resort to an operation which is always long and difficult, frequently unfortunate, and very often quite useless in results, while less complicated operations are followed by a regression of the other lesions present. A palliative treatment or epididymectomy will often give just as good results, without any of the above-named complications being possible. It were idle to deny that vesiculectomy has not given some excellent results, but I fear they are rather the exception than the rule, and

I maintain that removal of the vas deferens and seminal vesicles should be an exceptional operation, and that it is wiser to resort to simple vas-epididymectomy, while in some cases castration may be indicated.

IV

THE CLINICAL ASPECTS AND TREATMENT OF CYSTIC DISEASE OF THE BREAST (RECLUS' DISEASE).

Cystic disease of the breast can be diagnosed by three principal characteristics, the first of which is the great number of cysts present. This abundance is often so great that by mere inspection of the organ after its removal fifty or more may be seen, these varying in size—some quite small, others large. The second characteristic is the diffusion of the cysts. There is no tumor, properly speaking; the cystic degeneration is general throughout the breast. The lesion is diffuse and there is no one cavity such as is observed in the majority of other cysts, in the midst of a sarcoma or carcinoma.

The third characteristic is not less significant; the lesions involve both breasts, so that the disease is, consequently, bilateral. There are, however, exceptions to this rule, but they certainly are not numerous. It may perfectly well happen that the lesions in one breast are much more developed than in its mate, and they are, therefore, overlooked in the latter. The patient may, likewise, be unaware of the condition when it is less developed in one gland than in the other, but careful palpation will always reveal the presence of the lesion.

Oftentimes the patient, and even the surgeon, considers the principal tumor only, the larger of the cysts and, consequently, the one most in evidence. The gist of the affection, if I may be permitted thus to express myself, is neglected. By this is meant the presence of miliary nodules, similar to shot, lodged in the parenchyma. These minute cysts produce by palpation a sensation similar to grains of hemp glued on a hard surface. This is the best idea that I can give of what is detected by the hand of the examiner.

All these signs are quite sufficient in themselves to characterize the affection, but their detection is not always an easy matter. The differentiation is frequently vague between the normal glandular grains that can be felt subcutaneously in thin or withered breasts and small cystic dilatations. In point of fact large cysts may not

necessarily exist, and then, too, they may develop in the centre of the mammary parenchyma, and are not to be readily made out, being so deeply seated. The woody hardness to which sometimes these cysts attain is quite perplexing, even when they are no larger than a walnut, or even less. Fluctuation may sometimes be elicited, but it is safe to say that as a rule it is absent. Out of a total of thirty cases, Reclus himself met with it only five times.

The cysts do not adhere to the skin or to the deeper structures and the nipple is not retracted, although, in one case, reported by Renon, there was retraction, but this could be explained by the intimate connections uniting the galactophorous ducts with the involved glandular lobules.

A discharge from the nipple is a very important sign when present, and is the pathognomonic index of an abnormal secretion. Such a discharge, which is not common, is either spontaneous or can be made to flow by pressure on the breast. When spontaneous, it may be continuous or intermittent, the latter being the rule, and not infrequently during the intervals the cysts enlarge and the patient complains of pain. Then, again, cysts which were exceedingly hard before the appearance of the discharge become more supple and may give rise to fluctuation when the discharge has lasted a little time. If the discharge be serous in nature, of itself it is an excellent index as to the nature of the cysts. If bloody or brownish in color, it indicates the development of vegetations within the cyst cavities. However, the cystic discharge may very well be clear, transparent, yellow or slightly greenish in hue; at other times it is thick and contains an atheromatous substance of a light coffee or chocolate color. No matter what may be the appearance, it is always a mucoid substance holding in suspension the coloring matters of the blood, misshapen globules, neoplastic and granular cells, and sometimes crystals.

In the majority of cases the lymph-nodes are not involved; they are simply normal. When they are enlarged, microscopic examination has merely demonstrated an inflammatory process, but if malignant transformation has taken place in one or more of the cysts, the lymph-nodes become secondarily involved just as in any ordinary case of carcinoma of the breast.

An important symptom, to which little if any attention has been given, is pain. It may be due simply to distention of the cyst walls,

but there are cases where it is intolerable, to such an extent, even, that sleep is prevented.

Although cystic disease of the breast can be distinctly defined clinically, the same cannot be said of its pathology. The study of its relationship with cystic adenoma and intracanalicular epithelioma demonstrates that cystic disease is not a pathologic entity. It belongs to a natural series whose adenomatous process is the first phase, the ultimate being intracanalicular epithelioma, and thus we arrive at malignant tumor growth. Cystic disease is not a chronic mastitis, as there is absolute integrity of the interstitial tissue, but one with epithelial hyperactivity and neoformation. It belongs to the epithelial family, and it is because the epithelium of the acini proliferates in the neoplastic interpretation that the acini multiply and increase in size (adenoma), that they dilate (cysts), either by a circumscribed process (cystic adenoma), or by a diffuse process (cystic disease). And lastly, it is because the epithelium proliferates in the lumen of the acini that products are formed which ultimately end in intracanalicular epithelioma.

All these neoplastic products are, therefore, epitheliomata, but of a benign type, for the reason that there is no loss in relationship between the connective tissue and the epithelium. The connective-tissue stroma does not seem to participate except secondarily in the neoplasm, and is incited to proliferation by the superactivity of the epithelium which remains the fundamental and primary act of the process.

Total extirpation of the breast is the treatment on account of the danger of recurrence when a partial operation is done; and, above all, the danger of malignant transformation ultimately taking place.

PRIMARY CANCER OF THE CLITORIS

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CANCER of the clitoris has but little special interest outside the general field of carcinoma other than that of being a rare gynecologic condition.

Case referred by Dr. J. M. Carter, Eddington, Pa. Married, and mother of three children. Age 54. Menopause, 9 years ago. General health, robust. Urine, free from albumen and sugar. She had suffered from pruritus vulvæ for the past two years. She had noticed the growth for three months.

Examination disclosed a deep red hemispherical mass occupying the normal position of the clitoris. It was one inch in diameter, covered with firm granulations, and had a slight ulceration at the apex. The right labium majus showed an implantation growth where it lay in contact with the diseased glans. The labia majora, vestibule, and perineum showed the scratch marks incident to her pruritus (Fig. 1). There was no involvement of the inguinal lymph-nodes. Under spinal stovaine anæsthesia the diseased area was extirpated in one piece by an arrowhead-shaped incision, excising the upper two-thirds of the labia and exposing the roof of the urethra well back toward the triangular ligament. The suspensory ligament of the clitoris and the two crura were divided close to the pubic bone. Hemorrhage was trifling; three active vessels—the dorsal artery of the clitoris and one in each crus—were tied. The wound was closed by deep catgut and superficial horsehair stitches (Fig. 2). The inguinal lymph-nodes not being palpable were not removed.

Convalescence was uneventful. The result, three months after operation, is shown in Fig. 3. The pruritus vulvæ disappeared during convalescence and has not recurred.

The pathologic report of the specimen was epithelioma of the clitoris. The cancer cells were invested by dense fibrous tissue, through which there seemed but little tendency to perforate.

Two and one-half years after operation the patient reports no return of the growth.

	Age	Menopause	Married	Children	Family history of cancer	Location of growth	Age of growth	Frutitus	Implantation	Lymph-node involvement	Operation	Result	Remarks
Dr. Townsend, N. Y. J. A. M. A., 1891.	60	Yes	No	No	No report	Glans oclitoridis	2 years	?	?	No	Ligation	Metastases in liver in 6 months	Died.
Ditto	42	?	Yes	2	No report	Glans oclitoridis	?	?	?	?	Ligation	Metastases in liver in 8 months	Died.
Ditto	24	No	No	No	Yes	Glans oclitoridis	3 years	?	No	No	Cautery...	Recurrence in labia and meatus	Died in 16 moe.
Ditto	57	No	Yes	4	No report	Glans oclitoridis	?	?	No	No	Eraseur..	Metastases in liver and peritoneum	Died in 1 year.
Dr. Riddle Goffe, J. A. M. A., 1878.	43	?	Yes	None	No report	Prepuce...	?	Yes	?	Yes	Radical...	Recurrence in stump in 5 months	No recurrence after second operation.
Dr. Chas. Noble, 1900.....	60	Yes	Yes	Yes	No report	Glans oclitoridis and surrounding tissue	?	Yes	L a b i a minora	Yes	Radical with inguinal adenectomy	No recurrence..	Recovery.

FIG. 1.



Primary carcinoma of the glans of the clitoris, with an implantation carcinoma of the right labium minus.

FIG. 2.



Excision of diseased area with the crura and upper two-thirds of labia majora. Wound closed by buried catgut and superficial horsehair sutures.

Dr. Howard Kelly..	50	4 years	Yes	?	No	Glans clitoridis and labia minora	3 months	4 years	Labia majora	No	Extripation of clitoris and labia minora	No recurrence..	Recovery.
Dr. Howard Kelly..	38	No	Yes	?	Yes	Glans clitoridis	6 months	4 years	Labia majora	No	Extripation of clitoris and involution of tissue	No recurrence..	Recovery.
Dr. T. C. Smith, 1906 Wash. Med.	?	?	?	?	?	Prepuce...	?	?	?	No	Removal of prepuce	No recurrence..	Recovery.
Dr. F. H. Menhaue, 1907, J. A. M. A..	52	3 years	Yes	2	No	Glans clitoridis	3 months	2 years	Both labia minora	No	Radical...	No recurrence..	Recovery.
Dr. W. A. Steel, 1911	54	9 years	Yes	3	No	Glans clitoridis and prepuce	3 months	2 years	Left labium majus	No	Radical...	No recurrence..	Recovery.
Dr. Edis London, 1889, Brit. Med. Journ.	43	No	No	No	No report	Glans clitoridis	3 months	3 mos.	No	No	Cautery...	No recurrence..	Recovery.
Dr. Priestly Leech, London, 1894, Brit. Med. Journ.	29	No	Yes	3	No report	Glans....	?	?	?	No	Excision of clitoris	Recurrence in wound	Died.
Dr. Leigh Day, 1906, Brit. Med. Journ.	60	19 years	Yes	11	No report	Glans....	2 months	4 mos.	?	No	Excision of clitoris	No recurrence..	Recovery.

In 1903, Engström, from Continental sources, reported 69 cases of primary carcinoma of the clitoris; in his clinic he had seen the condition twice in 17,000 vulvar examinations.

From American and British sources I have been able to collect only fifteen cases, including the one reported. The average age of these cases was forty-seven years, of which two were under thirty years. The majority had passed the menopause. All but two were married. The majority had borne children. But two gave a family history of cancer. The glans clitoridis was the starting point of the growth in all but two cases, and in these it originated in the prepuce. The majority had suffered with pruritus vulvæ for varying periods before the carcinoma appeared. Implantation growths on the labia were common. There was a comparative rarity of inguinal lymph-node metastasis.

The operative procedures consisted of ligation, excision by knife and cautery, and total extirpation of the clitoris with surrounding diseased tissue. The inguinal lymph-nodes were removed in cases where they were involved. Recurrence was the rule where a simple extirpation of the growth was done, but occurred in no cases where the radical operation was resorted to.

It would be presumptuous to attempt to draw any definite conclusions from such a small number of cases, but certain common points in the series present themselves.

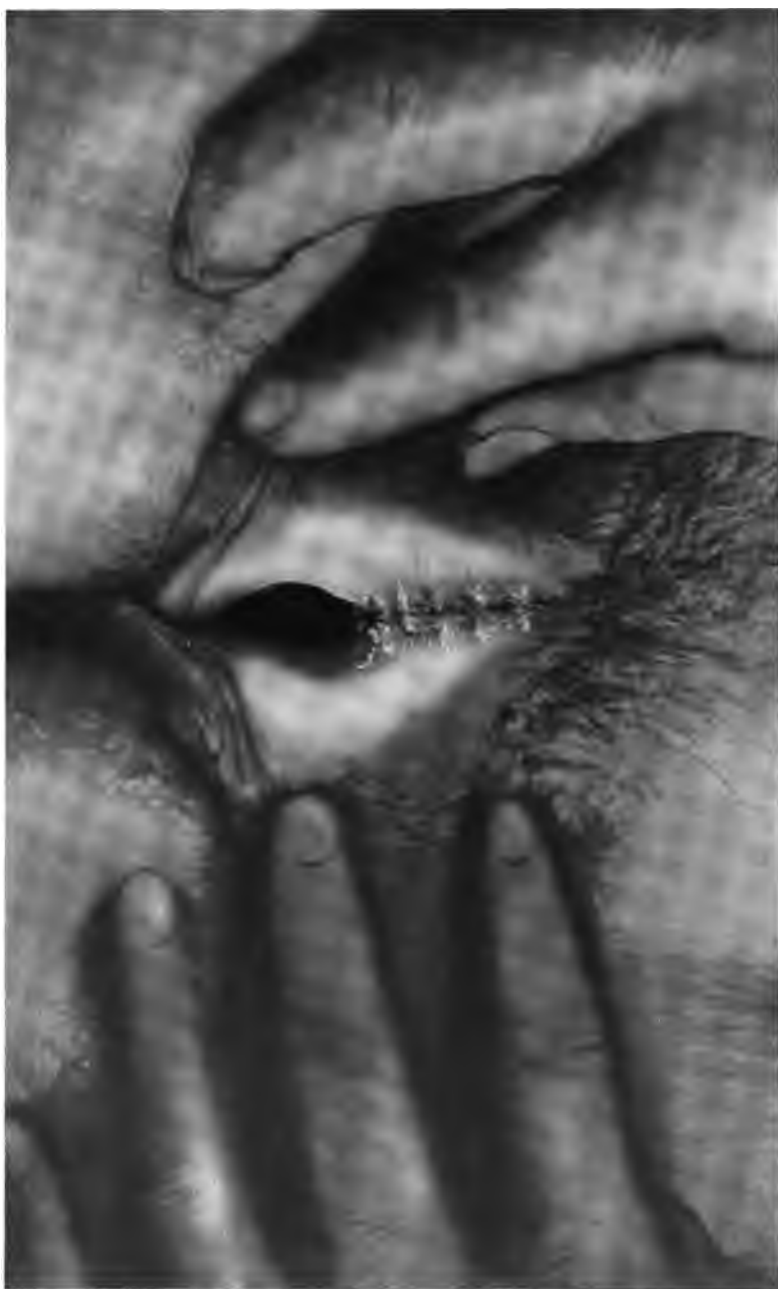
First, the rarity of the clitoris as a primary seat of epithelioma. In the same mass of consulted literature the cases of reported cancer of the vulvæ were about eight to one.

Second, that pruritus vulvæ furnishes the traumatic etiologic factor in the majority of instances. This is also the case in carcinoma of the vulva.

Third, that carcinoma of the clitoris is in the beginning a relatively local condition, as evidenced by late inguinal lymph-node involvement and lack of recurrence after radical operation. In this respect, it is analogous to cancer of the penis. On the other hand, vulvar cancer gives early lymph-node metastasis and is prone to recur after removal (Fig. 4).

The frequency of contact, implantation growths, is of interest as supporting the theory of cancer inoculation.

FIG. 3.



Result three months after operation.

FIG. 4.



Common type of vulvar epithelioma, involving labia majora or minora, and giving early inguinal lymph-node metastasis. Two radical operations were done three months apart, but the patient died of general carcinomatosis six months from the time of the appearance of the growth.

A CASE OF ECTOPIC GESTATION: DIAGNOSIS AND OPERATION BEFORE RUPTURE

BY CHARLES W. HIBBITT, M.D.,

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ECTOPIC gestation is so frequently encountered in the experience of the average surgeon, and the clinical data in connection therewith are so well understood, that reports of isolated cases attract no especial attention unless embracing features of unusual interest.

While many of the older authors believed the occurrence of ectopic gestation impossible unless preceded by inflammatory disease or abnormality of the fallopian tube, more recent clinical experience has demonstrated that tubal disease is not an essential factor, since ectopic gestation has been occasionally encountered in women never before pregnant and in whom there had been no history of previous pelvic infection. However, in the majority of instances there will be found a history of previous inflammatory pelvic disease, either an extension from appendicitis, from ascending gonorrhoea, or previous childbirth.

In this connection, while recognizing that the truth of the hypothesis may be incapable of actual demonstration, the writer believes that normally the ovum is invariably impregnated within the uterus, and that when fructified elsewhere the occurrence should be regarded as accidental and abnormal. This assertion is made without fear of refutation, although numerous authors contend that fecundation always occurs within the tubal lumen, the product of conception being thence transported to the uterus for lodgement. The important fact appears to have been overlooked, that if the ovum always became fructified within the tubal lumen there would be few normal gestations and natural deliveries; and this would apply especially if impregnation occurred in the outer third of the tube, because of the disproportionate size of the lumen near the uterine extremity as compared with the remainder, and the rapidity with which the product of conception develops.

With impregnation of the ovum and foetal development in any portion of the tubal lumen, rupture of the tube and extrusion of its contents into the abdominal cavity may be expected to ensue within a reasonable time, the average being between the third and fourth week. This rule, however, is subject to many curious exceptions, since cases have been observed where rupture of the tubal envelope occurred within a week after impregnation, and also where sufficient distention of the tube ensued to accommodate a four months' foetus. The latter is exceedingly rare, and under ordinary circumstances rupture may be expected within a month. In the case to be reported, although the gestation had progressed to about the sixth week, rupture had not occurred.

The symptoms incident to ectopic gestation after rupture have been so frequently described that to enumerate them would only entail useless repetition, and the diagnosis at that time presents no especial difficulty. Before rupture, however, there is always considerable uncertainty, and rarely is accurate diagnosis possible, it matters not what may be the erudition and experience of the medical or surgical attendant. According to Hayd, the diagnosis of tubal pregnancy is seldom made before rupture because patients cannot be observed sufficiently early, and usually when an early specimen is obtained it is because operation was undertaken for some other condition, or when a tentative diagnosis was made with merely a suspicion of tubal pregnancy, since a slightly distended tube—whether distended by serum, blood, pus, or an aberrant ovum—may give the same objective and subjective symptomatology. "If a mass be felt in a tube, an operation is demanded, and will save the woman's life in practically every case. There should be no mortality in cases of this kind, if diagnosed before rupture. The importance of immediate operation in all cases after the diagnosis is made, prior to rupture of the sac, cannot be overestimated."

While there have been reported numerous cases of ectopic gestation where operations were performed before rupture, the records fail to show the proportion in which accurate pre-operative diagnosis was made. Thus, one author (Fehling) refers to twenty-four patients subjected to coeliotomy for ectopic gestation before rupture, but the abstract of his original report does not indicate whether or not a correct pre-operative diagnosis was made in any case; and the same state-

ment will apply to the statistics of the majority of other surgeons. A case diagnosed and operated upon previous to rupture was reported by P. G. Skillern, Jr.¹ In so far as treatment is concerned, however, accuracy in diagnosis is of minor importance, since prompt coeliotomy is demanded in every case of ectopic gestation, whether observed before or after rupture.

The treatment of ectopic gestation is always surgical, and the earlier the patient is subjected to coeliotomy the greater the probability of a favorable ultimate outcome. As already suggested, there should be practically no mortality, provided operation be undertaken sufficiently early, unless an unforeseen accident happens. Certain authors contend that after rupture has occurred, the patient being in marked collapse from hemorrhage and shock, it is advisable to defer operation for twenty-four to forty-eight hours, under the belief that hemorrhage will cease, that reaction will follow, and that coeliotomy may then be undertaken with infinitely greater safety to the patient; but in the majority of instances the writer believes delay is dangerous, since hemorrhage may continue, reaction may fail to ensue, and the patient promptly perish. If one could be reasonably assured that cessation of hemorrhage and reaction would occur, coeliotomy might be safely postponed until a more favorable operative period; but, as this cannot be foretold, immediate operation appears the wisest course. Even if the patient be markedly exsanguinated and almost moribund from hemorrhage and shock, life may still be saved by immediate coeliotomy followed by appropriate postoperative treatment; whereas delay and continued hemorrhage would almost certainly prove fatal.

The specimen herewith exhibited is of interest principally because it represents a tubal pregnancy in which the diagnosis was made and operation performed before rupture had occurred.

I was recently called to a small town in Kentucky to see a woman of thirty years, the mother of two children, the family physician having made the diagnosis of tubal pregnancy. The patient was in good health until the birth of her last child, five years previously. After that she became infected, as the doctor said she had some elevation of temperature and other symptoms of inflammatory pelvic

¹"A Plea for the Early (Preperforative) Diagnosis of Extra-uterine Pregnancy," *Penna. M. J.*, August, 1912.

disease. Her menses were fairly regular until January, 1913. She did not menstruate in January or February, but slight hemorrhage from the uterus occurred in March, when considerable intra-uterine detritus was extruded.

The family physician saw the patient in January and thought he detected a slight enlargement in the right side of the pelvis. He examined her again in February, and, as the enlargement had increased in size, ectopic gestation was suspected. In March, when shreds and detritus escaped from the uterus, the diagnosis of extra-uterine pregnancy seemed certain. At this time I was called in consultation. The patient had constantly suffered from increasing pain since early in February, but there were no other symptoms, not even slight elevation of temperature, and her pulse was likewise normal.

The patient was anæsthetized and a mass found in the right side of the pelvis near the uterus, but apparently not connected therewith. The uterus was not freely movable, and was slightly enlarged.

Cœliotomy revealed a tremendously enlarged right fallopian tube, which was adherent in the pouch of Douglas and to the right broad ligament. After separating the adhesions, the tube with its contents was easily removed intact, the tube being ligated near the uterus.

The tumor is nearly four inches in diameter and four to five inches long. There was much dark blood in the tube, and the foetus was found in the gestation sac. Unfortunately, in opening and handling the specimen the foetus was partially destroyed, but the remnants can be plainly distinguished.

There was no fluid or blood in the peritoneal cavity, and no evidence of gross pathology elsewhere. The most interesting feature is that the diagnosis was accurately made by the family physician and the operation was performed before rupture.

The condition of the patient was satisfactory during the operation, no untoward symptoms developed thereafter, and she made a perfect recovery.

THE THYROID GLAND, WITH ESPECIAL REFERENCE TO GOITRE

BY J. GARLAND SHERRILL, A.M., M.D., F.A.C.S.

Louisville, Kentucky

Circulatory Disturbances.—The variation in the vascularity of a thyroid gland within normal limits is considerable. Undoubtedly this is a sex gland in addition to its other functions. An increase in vascularity and, therefore, in the size of the thyroid occurs at puberty, during menstruation, after coitus, and in pregnancy. The number of enlargements in females greatly exceeds that in males. Hemorrhage into the gland is not of infrequent occurrence in cases of goitre. Inflammation is rare in the normal-sized gland. Acute inflammation of the goitrous gland has been observed occasionally. The symptoms are often distressing. Local swelling, tenderness, and heat are present, accompanied by extreme anxiety, nervousness, dyspnoea, palpitation, cardiac distress, sleeplessness and often muscular tremor, in fact, exaggerated symptoms of Graves's disease. These cases are best managed by free purgation, application of ice over the gland and over the heart, absolute rest in bed, and the administration of some sedative, such as a bromide. Opium should be avoided, as individuals of this type are prone to become *habitues*.

Following some of the infectious diseases suppuration in the gland has been reported, but is rare. Some writers describe a form of chronic inflammation which does not produce hyperthyroidism, but diminishes the size of the gland. Tuberculosis occurs rarely, and is usually found in connection with systemic infection. Syphilis of the thyroid is an exceedingly rare condition.

The enlargements of the thyroid gland may be divided into (a) simple, (b) exophthalmic, and (c) malignant. Simple enlargement is perhaps the most frequent affection. It grows steadily, perhaps accompanied at intervals by a rapid, but temporary, increase without nervous phenomena or other symptoms than increase in size. In time it may produce symptoms from pressure upon the trachea, laryngeal nerve, or other structure, and the patient consults a physician be-

cause of the deformity. In some instances symptoms of hypothyroidism are observed.

The second type, known as Graves's disease, is always a form of hyperthyroidism. Usually enlargement of the gland is present, but the symptoms may develop without visible enlargement. Advanced cases are readily recognized, but in the early stages this type may be easily overlooked. Exophthalmos, enlargement of the thyroid, tachycardia, palpitation of the heart with irregularity, nervousness which may be extreme, muscular tremor, vertigo, and paroxysmal dyspnoea occur. While some of these symptoms may be absent, in most of the severe cases all are noted. There is a tendency to cardiac dilatation. The cases coming to autopsy show this condition to a marked degree, as well as fatty degeneration of the heart musculature. These changes account for the sudden deaths which occur in some cases.

The diagnosis of the different forms of goitre should not be difficult if careful observation of the patient be made from time to time. The location of the enlargement and its motion with the trachea during deglutition are sufficient to prove its thyroid origin. The absence of symptoms characteristic of Graves's disease and the very slow growth favor the diagnosis of a simple goitre. The presence of even slight bulging of the eye and rapid heart action are sufficient to diagnose exophthalmic goitre. Where these symptoms are not well marked, the presence of muscular tremor, especially after brisk exercise, points to this affection. Certain ocular signs are also valuable in the early diagnosis of this condition. The most important of these is what is known as von Graefe's sign, although described eight years previously by Demarres. In the movement of the eye downward the eyelid does not follow the line of vision normally, but does so in an irregular, spastic manner. Stellwag called attention to the fact that in cases with marked exophthalmos there is present a retraction of the upper eyelid, while the lid remains much more stationary than it does under normal conditions, and there is a decrease in the frequency of winking. Moebius, in 1895, observed that in goitre there is insufficiency of convergence.

Malignant disease may be recognized by its sudden and very rapid increase in size, perhaps by its increase in density, and by enlargement of the regional lymph-nodes. If the mass become attached to

surrounding structures it shows infiltration, and this is strong evidence of malignancy. It is well to remember that fixation may follow the use of injections into a simple goitre. Cachexia and loss of flesh occur early in carcinoma.

The prognosis varies greatly, depending upon the variety and the faithfulness with which treatment is employed. In simple goitre the prognosis is usually good. It must be understood that exophthalmos may develop at any time. In Graves's disease the prognosis is more serious, and, while some patients respond rapidly to treatment, a large number do not. Surgery is fraught with considerable danger in this class, and still the results are remarkably good, especially if operation be performed before cardiac changes are advanced. The malignant form is especially grave, permanent cure being rarely obtained. The operative mortality, too, in this form is great.

This brings us to a consideration of the treatment. What are we to advise patients suffering from goitre? My personal experience has led me to the following conclusions, which may not agree with the views of others, but I feel very safe in the stand I take.

In all simple enlargements, during the early stages I advise medical treatment. This consists of careful attention to the water supply, general care of personal hygiene, the employment of iodine internally and locally, and the administration of thyroid extract. In the presence of hyperthyroidism, the employment of thyroid extract accentuates the symptoms so promptly that a diagnosis can be made and the remedy discontinued. This plan has controlled the affection in a large number of cases coming under my observation. McCarrison has found thymol beneficial in certain cases. Ochsner commends very highly the treatment of simple goitre by injection of five per cent. carbolic acid solution directly into the gland, as proposed by his old teacher, Gunn. It seems to me that a large percentage of cases of goitre, especially of the simple type, ought to be cured or at least any increase in the size of the growth prevented without the necessity of subjecting the patient to operation.

An objection to the method of treatment recommended may be urged because of the adhesions that may form, thus rendering subsequent operation more difficult. Some observers have reported excellent results from the use of chromium sulphate internally, and, as already stated, McCarrison claims to have obtained a cure in sixty.

eight cases by the internal administration of thymol. Others have recommended the employment of the X-ray, the introduction of iodine into the substance of the goitre by cataphoresis, etc.

Failing to obtain improvement by medicinal measures, partial thyroidectomy is to be recommended. For the exophthalmic type the most important therapeutic agent is rest. This consists of rest in bed when the symptoms are aggravated, with absolute freedom from excitement. During convalescence the patient is forbidden to indulge in dancing, card playing, and all other social activities conducive to excitement. Sexual intercourse is prohibited and fatiguing exercise avoided. A change in water supply or boiling the water is desirable. The writer has found the tentative employment of iodine locally and internally beneficial, although some condemn the internal administration of the drug in this disease. The use of hydrobromate of quinine has been beneficial. The serum treatment of Beebe and Rogers may be of service. The administration of thyroid extract is contra-indicated, as it may aggravate the symptoms.

Following this plan of treatment, the most exaggerated cases will show amelioration of the symptoms, and, even though only a small proportion be restored to health, yet many may be brought to a condition more favorable for operation. It must not be overlooked that in exophthalmic goitre there may occur recession of the symptoms even without any treatment. It is unwise to operate in the presence of stormy symptoms, as in most cases the patient may usually be so greatly improved that operation can be undertaken with much less risk. In malignant cases early and radical removal offers the best chance. Grafting of thyroid tissue may sometimes be necessary to supply the loss of gland tissue resulting from the necessarily radical operation.

Operative Treatment.—In hypothyroidism the operative risk is less than in cases of hyperthyroidism, and yet the technic is almost identical. The surgeon first determines whether or not a total or a partial extirpation of the gland or one of its lobes is indicated. In some, ligation of one or more of the vessels may alone be performed. In a few instances this suffices to obtain a symptomatic cure. In others it is simply the first step to a more complete operation later. Some believe that ligation of the vessels yields almost as high a mortality as the more radical procedure, claiming that the manipulations require just as much time and produce greater damage than extirpation.

Before operating, the best anæsthetic for the individual case should be selected. Opinions differ upon this point. Some prefer local anæsthesia as the best method of conserving the patient's strength, while others employ general anæsthesia, and still others (notably Crile) prefer the anoci-association method, for which it is claimed that noxious psychic influences are removed. The writer believes that, properly selected, any of these anæsthetics will prove safe.

Crile, of Cleveland, and Dunhill, of Melbourne, have given some very interesting reports upon the operative treatment of goitre in recent years. Their results are practically the same, although their methods of anæsthesia are quite different. Crile claims that operative shock and the mortality rate are removed by anoci-association, believing that by keeping the patient in ignorance of the date of the operation, and giving her the impression that she is being treated by daily inhalation methods as a matter of course, he can eliminate psychic shock and thus obtain more favorable results. By preceding the general anæsthetic with morphine and scopolamine he claims to have reduced considerably the number of devitalized brain cells. He substitutes nitrous oxide for ether, and says that this has also reduced the devitalized cells to one-quarter!

Dunhill's work is remarkable. He employs a one per cent. solution of novocaine, using several ounces for local anæsthesia, infiltrating all the tissues in the front of the neck. The most significant feature, however, is the fact that he operates on patients having the most advanced muscular changes, with weakened hearts, and refuses almost no case. He reports four deaths in three hundred and eighty operations of all classes, of which two hundred and thirty were exophthalmic—an excellent showing. To the writer this practically refutes Crile's method of "stealing" the thyroid. Most of the patients prefer prompt operation after entrance to hospital. The anticipation and dread of operation, the time of performance of which is uncertain, seem to me more liable to produce psychic shock than for the patient to know the exact date thereof. And Dunhill's work seems to prove that the operation is safe in the most serious cases without increasing the mortality distress to the patient, although conscious throughout. I believe that careful hæmostasia, with rapidity of operation and little manipulation of the gland, will enable surgery to be performed with comparative safety.

In the technic it is well to manipulate the gland structure as little as is possible, thus avoiding expression of its contents into the exposed tissues, thereby producing symptoms of hyperthyroidism immediately subsequent to operation. The more rapidly and dexterously the operation be performed, the less the danger of the development of such symptoms. Most operators employ drainage to permit escape of excessive secretion. The necessity of drainage has been an open question in the mind of the writer. Some of our results have been as good without drainage as with it.

Among the dangers of thyroidectomy are hemorrhage and sepsis, both of which may be avoided by competent surgeons. Injury to the inferior laryngeal nerve should not occur if the technic be carefully planned, although in some very large growths there is such anatomic distortion as to make it difficult to avoid such an accident. Injury to the oesophagus has resulted in a troublesome fistula. In the treatment of postoperative tetany extract of thyroid gland or the parathyroids is indicated, the combination being most effective. Even without injury to the laryngeal nerve, some will complain of husky voice, or even of marked hoarseness. This usually subsides rapidly. In many instances the operation is performed purely for cosmetic reasons. It is advisable, therefore, that the incision be made so as to leave minimum deformity after healing. This is attained by placing it in one of the natural creases of the neck.

In conclusion the writer emphasizes the following:

- (1) In a large percentage of cases of simple goitre the patient may be relieved by medical treatment.
- (2) In some cases of exophthalmic goitre the patient may be cured in the same way, but most should be operated upon before degenerative changes have destroyed the cardiac musculature.
- (3) In all cases the surgeon should carefully select the anæsthetic that is best suited to the patient and to his own convenience.
- (4) The operation should be performed without loss of blood or of time, and with the least manipulation of the gland.
- (5) In certain cases the thyroid and parathyroid extracts are indicated.
- (6) The same hygienic rules should be observed after as before the operation.
- (7) The results of operation have been good, the mortality being between one and two per cent.

Child Welfare

THE PHYSICIAN AND THE CHILD

BY SIDONIE MATZNER GRUENBERG

Author of "Your Child Today and Tomorrow"

EVERYONE knows how important it is for the physician to gain the confidence of his patients. The charlatan overemphasizes this side of the relation and plays exclusively a "confidence game." The honest practitioner of the medical arts needs, with the ability to inspire confidence, his technical equipment. If he is to treat children, he must have in addition the ability to get the affection of the young patients.

It is possible, with the help of a certain native shrewdness, to gain the confidence of people, and to an extent one may deliberately play on their affections. But the man who can get the affection of very young children without himself having a genuine and sincere sympathy for them is very rare indeed. I am tempted to say that there is no such man, but admit that there are a few, so as not to appear arbitrary. I do not mean that you must gush sentimentally with every child you see; but you must have a genuine appreciation of and sympathy with the feelings of children. You cannot deceive the young child with flattery that he does not understand; it is altogether a matter of feeling, and to this most children are very sensitive.

There are many men and women who have exalted ideals in regard to serving their fellows, who devote themselves with high resolve, and who sacrifice their own convenience and even their health for the sake of helping others; but if they have not a certain temperamental "knack" for getting at the inside of a child's heart, they should apply their devotions and energies in fields unoccupied by children. In medicine, as in education, technical equipment must be supplemented by an understanding of the very people with whom work is to be done. Some succeed with adults who fail miserably with children, and *vice versa*.

The importance of an understanding of psychology to the physician is a commonplace; yet only about a dozen medical colleges in this country require training in psychology of all their students. But the leaders in medical education are rapidly coming to recognize that such a training is essential. In reply to a *questionnaire*, some two years ago, three-fourths of the deans and professors favored special instruction in psychology for medical students, while only ten per cent. did not approve the idea; 15 per cent. gave qualified replies.¹ To be sure, many physicians, through quick observation and sound judgment, and as a result of years of experience with people, manage to understand enough of "human nature" to meet the daily needs of their practice, without any systematic study of psychology. But many who have sympathy for children have not the opportunity to acquire through experience the necessary knowledge of child nature; these can certainly be helped by the experience of others. For such the study of the results of experiments and observations in the field of "child study" should form a part of the professional equipment, if they are to deal with children.

The first obstacle that the physician has to meet in treating children is the attitude of the little patient. This is most frequently wrong because of the ignorance or shortsightedness of parents, and it is the parents who have to be attacked. Parents have to be taught that, whatever use they may make of the policeman or of any other bogey, the physician must *not* be used to frighten children into being "good." The child must come to look upon the physician as a friend, a helper, but the physician alone cannot, as a rule, bring this attitude about without the help of the parent. And in most cases the physician himself has to train the mothers.

The fear of the physician on the part of the child is often a serious obstacle to diagnosis, let alone treatment. In one case the visit of the physician threw the child into spasms, delaying the diagnosis of pleurisy until it was apparent that the wrong man was on the case; it was necessary to call in a stranger that the child did not know to be a doctor before anything could be done. But in less ex-

¹ Franz, "On Psychology and Medical Education," *Science*, 38, p. 555 (1913). Abbott, "Psychology and the Medical School," *Amer. J. Insanity*, 70, p. 447 (1913).

treme cases, even, the practitioner has the choice between putting the patient entirely at ease and making a satisfactory examination on the one hand, and allowing the child to be agitated by his feelings and then "making allowances" for palpitations or fever or irregular breathing or other physical effects of fear on the other hand.

With the right attitude on the part of the child, the word of the physician acquires an authority not exceeded by that of the minister or the teacher, or of any other person with whom the child has relations. What the doctor says then comes to be law, and that not merely in matters pertaining to health and sickness, but in the whole conduct of life.

For the purpose of securing this attitude, the physician must be perfectly frank with the children. If you have once told a little girl that cutting out the tonsils will "not hurt more than cutting off a finger nail," you may ease your conscience with the mental reservation that you mean cutting off the whole finger nail, but you will not have the confidence of that particular little girl. It is much better to draw upon their pride and fortitude to endure a little pain—even to exaggerate the pain that is to be endured—than to minimize the prospective suffering. In the latter case the reasoning of the child will assure it that you are either a cruel and unsympathetic brute, not caring how much he suffers, or that you are a—liar. In either case you undermine your standing as a friend, philosopher, and guide with the child.

But being perfectly frank does not mean being brutal. All children appreciate sympathy, but most boys, and certainly many girls, resent everything that has the remotest flavor of sentimentality. In *trying* to be kind, therefore, there is always the danger of overdoing it, and of making the child "shut up like a clam."

In the third place, if the child is to look upon the physician as a friend and helper, the latter must have the air of a helper, not so much in elaborate manipulations or in looking wise or in impressive speech, as in definiteness and decisiveness of his acts and utterances. This is, of course, equally true in the treatment of adults; but children are extremely sensitive to the slightest hesitancy.

Finally, if the child is to get the right attitude, he must be treated as something more than a case. Every expression of interest in personal concerns—games and toys, or school and parties—

is an indication that the physician is, after all, a human being, a person that understands.

Closely related to the problem of getting the child's confidence and friendship is that of the child's impressionability. Long before an infant can understand what is spoken, it is influenced by the tone of voice; and, while it is absurd to speak to a baby as if you expected it to understand, you may as well speak kindly to the little one, for that is the only way you can make the kind of noise that will soothe it. There are some voices to which children are instantly attracted; and there are others that as immediately repel children. But many of us have voices that are quite good enough, but we do not know how to use them. This is a matter of great importance to physicians as well as to teachers. The teacher has the advantage that the child is compelled to stay long enough to become familiar with the voice and the rest of the personality; but with the physician the earliest impressions that the child gets are likely to be the only ones.

A mother brought a four-months-old infant to a well-known children's specialist, who received them with the air of a colonel, or at least a major. His first greeting, "Good-morning," frightened the child, who burst into tears. "Quiet the child!" commanded the physician—which did not have the desired effect. The mother retired into another room, and soon had the baby quiet. But the moment she brought her into the presence of the expert the child began to howl again. For a children's specialist to carry about a voice of this kind is not conducive to efficiency, since it involves the loss of a great deal of time and energy; it is not good business, for it must alienate a good many prospective patients; and I venture to say that it is not good *medicine*.

With older children the use of the voice is quite as important as it is with infants. There is something in the tone that will sound a challenge to a seven-year-old boy; and the reaction is one of defiance. It may be something peremptory or domineering, it may be a suggestion of impatience or irritability, but the result is the same: the muscles become rigid and you cannot induce them to relax. This condition, I take it, is not very helpful to the physician. The voice being so largely a reflection of the mood, it is likely that the physician's own attitude toward the child must needs be remedied. The right tone will be secured, I believe, if the physician, instead of

approaching the child as a subject to be examined and treated, invites the youngster to come with him on a venture in which both are extremely interested.

No physician is so young as to be able to remember the mental processes of his own infancy and childhood. Even the youngest may therefore find it worth while to give some attention to the workings of the child mind. A physician who had been practising for some ten years was called in to look at a baby of seven months who was apparently suffering from some acute pain. The physician asked the mother a number of questions, and among them this: "Did he point to his ear?" If it was necessary to find out anything about the condition of the ear, the use of the speculum was indicated. The physician ought to know that the infant cannot, in the first place, localize the pain. Even a child so old as three years may not be able to localize a pain of the ear any more closely than to say that it is in his head or in the neck. In the second place, he ought to know that the infant cannot correlate his movements sufficiently to point to where he thinks the pain is, even if he could locate it.

The ailing child has a general feeling of distress or discomfort, and the physician whose experience has been specialized with children has learned the necessity of making a thorough examination each time that there is anything amiss. But among the general practitioners there are still too many who ask the mother or nurse, "Of what did the child complain?" This type of question is for the most part futile, so far as children are concerned, because of the peculiar workings of the child's mind.

Some children "complain" of all possible and some impossible things, because they have learned that is one way of receiving the attention that they crave. They exaggerate trifles, and, where there are no trifles to exaggerate, invent complaints, duplicating symptoms that have been effective on previous occasions; and they bodily "lift" the symptoms suggested by the complaints of their elders or the questions of the physician.

On the other hand, there are children who skilfully conceal their aches and pains for fear of being confined to bed or to the house. The child who has experienced a restraint because of having complained of a sore throat unconsciously balances the discomfort of the pain against the discomfort of the restraint, and acts accordingly.

Or the memory of unpleasant medicines makes him pretend that all is well when his appearance may be alarming to the mother. A boy of five continued to protest that he felt "all right" when his temperature was at 105 degrees and his drawn face gave evidence of suffering.

These two types of children, while representing opposite extremes, are in reality very common; indeed, nearly every child at one time or another acts in a way that may seem to adults to be "untruthful." But the child who claims to have aches that he has not, or who denies having aches that he has, need not be lying at all. Without purpose, without consciousness even, the young animal acts in accordance with associations that have been formed: "stomach-ache"—*get-petted*, or "twisted ankle"—*stay-in-bed-with-new-toy*; or he has formed an unpleasant association, like "sore-throat"—*can't-go-out-with-the-fellers*.

The child instinctively adopts a line of action that makes his testimony worthless. This is true because, as commonly recognized by lawyers, the child observes inaccurately, and confuses what he sees with what he remembers or imagines. In his relation to the physician who asks questions the child behaves as he always does towards one who asks questions. If the attitude be friendly, the child gives the answer that he believes will please the questioner; if the attitude be unfriendly, he automatically gives replies that create a false impression. If the attitude be that of indifference, the questions suggest their own answers, unless the physician is an exceptionally clever questioner. In any case, the misleading and untrue statements are not to be condemned as lies. In the first place, to do so is to draw the child's attention to what he has done, making him aware of the facts of lying; secondly, rejecting his statements in this way only arouses resentment and makes it more difficult to get any more information from him. It must be remembered that until about four or five years of age at least the child's "lies" are quite irresponsible; and a lie, to be a lie, must be purposeful.² In general, however, it is better to avoid tempting the child to say things that are not true; and the fewer questions that are asked him about himself the better, for they only tend to make him self-conscious.

² Hall, "Children's Lies," *Amer. J. Psych.*, 3, p. 59 (1890). Printed also in his "Educational Problems."

All who have to do with children must constantly take into consideration the prominent rôle that imagination plays in their mental life. The child normally assimilates into his world all sorts of ideas that suggest themselves from bits of conversation that he overhears, from glimpses of passing scenes, from pictures and from what is said to him directly. He combines these various elements in ways that are quite novel, and often unrecognizable, even to his most intimate associates. Moreover, his imagination is at the same time so vivid that it is impossible for the child, during a certain part of his development, to distinguish between the creatures of his imagination and the concrete realities of his experience. These peculiarities of the child's mind must often be of significance when it comes to diagnosing an ailment, as well as when it comes to treatment. An example of an extremely vivid imagination in a young child illustrates what I have in mind.

A boy of two and a half years was playing one day with a fanciful baby sister. "A member of the household came into the room, whereupon he immediately broke out screaming wildly, and became very much agitated. It took some time to quiet him and to find out that the cause of all his trouble was the fact that this person had inadvertently stepped upon his imaginary sister. Before him he saw his little sister crushed, and great were his horror and grief."² A child of this type must needs be handled carefully when he is quite well, not to mention when he is ill. And the play of the imagination must be taken into account even in disorders that are not directly of mental origin.

Because of the extreme impressionability of most children, the physician must be constantly on guard against discussing symptoms in the presence of children, on the assumption that they do not notice such things. The fact is that they notice a great deal more than adults ordinarily do; and are just as likely to be influenced as the proverbial medical student who, in the course of his studies, successively developed all the diseases in the book except "housemaid's knee." But not only should symptoms and ailments be avoided as topics of conversation in the presence of children, but the child himself, or "what children do," should never be mentioned. But the impressionability of the child is not to be feared; as every experienced practitioner knows,

² Gruenberg, "Your Child Today and Tomorrow," pp. 47, 48.

it may often be utilized to good purpose. An interesting case came to my attention some time ago. A little boy was to have his adenoids removed, but was not told what would happen to him. As he was coming out of the influence of the ether the nurse happened to be holding his foot. The child at once jumped to the conclusion that the doctor was doing something to that organ. Later, however, he asked his mother: "If the doctor fixed my foot, why does my throat hurt so?" The mother could not tell him; but found that rubbing his foot had a remarkable influence in driving away the pain in his throat.

Another way in which the child's mental processes may interfere with a satisfactory interview is through his susceptibility to the disconcerting influences of personalities. This shows itself especially in the reticence of a child in the presence of a third person as the parent or the nurse. For this reason physicians often get better results in examining even a young child—say six or seven years—by himself.

The many jokes on the style of the one about the Irishman who took as much powder as he could get on ten pennies because he did not have a dime handy, reflect somewhat on the intelligence of the patients; but they reveal a tendency that is common to very many classes of the population—the tendency, namely, to take for granted that the other person knows what we know *in the same terms*. The physician shows this when he advises a patient to confine himself to a "soft diet," or when he recommends that he "avoid starches." How many people really know what is meant by a "soft diet"; and how many know anything about "starches" other than the ones used in the laundry or directly labelled "corn starch"? With children it is even more important to be careful in the choice of words. A physician who regularly examines the children in a well-known school asked a six-year-old whether she had ever had any "contagious disease." The child had had such things, but not under that name. At another time he directed a ten-year-old child to have his mother see that he had an "intestinal evacuation." Probably no serious harm was produced in these two cases. The only point I wish to make is that a physician who has to deal with children should make himself acquainted with the vocabulary and with the mental processes of the children. This suggests that the mental processes and interests of a

child vary from time to time. The physician who some time ago asked a one-year-old baby to "stick out the tongue" has no doubt learned by this time that a baby of that age may imitate the movement of sticking out the tongue, but that he cannot understand the order until he is considerably older. Of course, a child of this age can be taught to stick out his tongue, or to point to his eye, or show "how tall he is" in response to a verbal stimulus; but this is a mere trick, and not an understanding of the words. It was, perhaps, the same physician who attempted to distract a three-and-a-half-year-old boy while draining the "water" from his chest by dangling a gold coin before him. He had no doubt found this device effective with infants, and did not realize that a boy of this age could not be reached so simply. He might at least have lent him the stethoscope, or something equally novel or intricate. One physician succeeds in interesting children of a wide range of ages by means of the centrifuge. It might not be a bad plan for physicians to borrow from the photographer the idea of having an assortment of toys always on hand, suitable for children of all ages, in addition to the customary chocolate or candies. However, I am aware that there are many physicians who succeed in holding the interest and affection of children without the assistance of any extraneous devices.

It is often difficult, or even impossible, to distinguish between a child's stubbornness and a real physical inability to take a medicine as presented. Some children do not like to swallow a pill; others simply can not. Some children are extremely sensitive to odors or tastes, and this variation has to be taken into consideration. A useful device for getting a child to swallow a fluid is to make a game out of the feat of holding some water in the mouth and trying to introduce the medicine spoon between the lips without spilling a drop.

The growing interest in sex instruction, combined with the fact that most parents are quite incompetent to impart the necessary information to their children, throws upon the family physician the delicate task of initiating the young into the mysteries of reproduction. To this end an understanding of the child's mind, in addition to a knowledge of the subject matter, is of the greatest importance. Especially delicate is the task of discovering in a child the presence of bad habits, without suggesting the habits to the child that has not acquired them.

This field of instruction in sex matters, of corrective work in sex habits and the field of medical inspection in schools and health supervision open large opportunities for specialized work in medicine. Any physician who contemplates a career in one of these new fields, as well as any who specialize with children in the ordinary lines, or whose practice brings him in touch with many children, must have a knowledge of the fundamental principles of genetic psychology. The usefulness of a worker in these fields will be to a large degree proportionate to his sympathetic understanding of the operations of the child's mind, for pædiatrics is closely akin to pedagogy.

Medical Problems

BIG FEES

BY M. V. BALL, M.D.

Warren, Pennsylvania

IN these days of muckraking it may be unwise to enter a plea for the man of wealth, and it is only in order to point out the evil in our own profession and, if possible, aid in abolishing it that I take such a stand.

Our profession has ever been ridiculed for treating a man according to his pocketbook. What is a simple belly-ache in a poor man is denoted as appendicitis in rich, and treated accordingly. Is it not possible for our profession to put itself on the basis of charging according to the services rendered and not in proportion to the amount the traffic will bear? The life of a rich man is not one bit more important to society than the life of a poor man. A poor man is worth as much to society as, if not more than, many of the idle rich. To charge a rich man \$3000 for an operation that is usually performed for \$100 is, in my humble opinion, a shameful robbery and at the bottom of more quackery than all the other irregularities in our profession. But, you will say, what about the very poor who are treated for nothing? Let us, once for all, quit talking about this charity, charity that we brag so much about and do so little of. If we were to say to the rich man, "We tax you \$2900 to take care of those who cannot afford to pay, and render him a proper accounting for his money," it would be honest. The rich man should receive the credit for his bounty and not the doctor. Someone will say that the rich man demands more time. If you wish to cater to the whims of the rich and give him unnecessary services for which he is willing to pay, there is no cause for complaint, but this is not the basis on which fees are rendered. If the treatment of the poor were put on a proper basis there would be no such thing as charity work. The State cares for the insane and pays physicians for such care. If physicians are willing to do indifferent work for nothing as an ex-

cuse for robbing the rich, communities will be content to let them do it so long as they are ignorant of the true conditions. If the proper medical attention were given to every person needing it, just as education is provided, then the State would be compelled, through public or private agencies, to raise sufficient money for such purposes and give the physician proper compensation, and the rich would have to bear their proportion.

To demand a large fee because of special ability is an entirely different matter. There are eminent men in our profession whose services are worth more to anyone, whether he be rich or poor. Such men should command proper rewards in order to save them for the work for which they are best fitted. Such men should be properly subsidized by the State and their special talents made possible for the many. Something of this sort has already been done in research work with men like Flexner in our own country and Koch and Pasteur in other lands. We would not expect a Mayo or a Halstead to bother about a carbuncle when they might be employed continuously with the work that has made them famous. If the ability is of an extraordinary nature it should be socialized. I believe that this catering to the rich, while by no means a new evil in our profession, has reached a serious stage. We read of an *accoucheur* receiving a fortune for a few weeks' attendance upon the wife of a millionaire and of surgeons demanding or obtaining a mercantile report before undertaking an operation and regulating their fees accordingly. We should all be paid according to the services we render and our ability, and paid for all the work we do. This would at once put an end to the political jobbery that many physicians are engaged in order to obtain appropriations for their pet institutions. It would put an end to the abuse of the poor in the free dispensaries and clinics; to maltreatment at the hands of careless physicians who fail to take their appointments seriously because the services are gratuitous. It would likewise stop the abuse of the privileges on the part of those not requiring them—the so-called dispensary evil. It would prevent the robbing of Peter to pay Paul.

If there are other reasons than those I have mentioned why a man of wealth should pay more for the same services than the poor man, I hope that some other member of the profession will enlighten me.

THE WASTE IN MEDICAL EDUCATION

BY J. H. MACKAY, M.D.

Francitas, Texas

LIFE is brief and art is long, and the disparity is constantly widening until time must ever be regarded as the most important factor in all human undertakings. To adjust art to life is, therefore, the chief problem that confronts educational institutions to-day. The supreme demand of the age is for efficiency, and this can be attained only by the adaptation of specific training to special work. Efficiency is the power to dexterously and expeditiously accomplish a given task. It is more than knowledge, or skill, or proficiency. It is the synthesis or productive result of all these transmuted and applied through individual capability. This must be acquired "by large experience in which just the essential things have been frequently observed and appreciated" (O'Shea). Formal training is an illusion (O'Shea, Thorndike, Scripture). Training other than specifically bearing on the work to be accomplished is largely valueless to facilitate the acquisition of or to intensify efficiency.

In this time-saving and practical age the wasteful, irrelevant, and disconnected methods of teaching isolated facts in medicine and the impractical series of chemical, mechanical, and physiologic experiments that are of doubtful utility in the practice of medicine are out of harmony with the spirit of the age that demands purposeful methods in training men and women for life's work.

At the threshold of a medical education the student must acquire a new language—the medical vocabulary—and he can acquire it only by memorizing it haphazard with other nondescript information. Moreover, it is a polyglot of thousands of words of fanciful creation for diseases, structures, and functions that give no associative index for their application. There are duplicate and even triplicate names, and the classification may differ with each author.

The cortical neurons are supposed to be the storehouse of memories, and the association tracts receive and discharge impressions.

The vividness and frequency with which impressions of a given object are received, and the clearer, simpler, and more connected these impressions are interpreted, the more acute, prompt, and elastic will the memory be. The harmonizing of impressions by which the name of an object is suggestive of its nature and environment, or is related by association or contiguity to other groups, ideas, or objects, increases the celerity and capacity of memory and withal the storehouse of efficient knowledge. Judged by this standard, medical terminology violates the most vital and fundamental rules of education.

The medical curriculum is of a piece with its nomenclature. Detached information is promulgated piecemeal in broken intervals by a score or more of teachers, many of whom have had but indifferent preparation for their work. The day's work may range from experiments on frog's legs to the mathematics of optics, changing abruptly each hour. There is no symmetrical blending, correlation, successive teaching, or associative appurtenance to pathologic conditions, and the student must, perforce, memorize all this confusing jumble and harmonize its concordance according to the capacity of his own mind. Obviously specialism cannot be expert and look very far beyond a restricted field, and hence the limitations of aggregate specialism devoted to seriate teaching.

Medical examinations, both collegiate and State, exemplify the same utter lack of solidarity. If a person should select, blindfolded, from a hat questions taken at random from text-books they could not be less contextural than those given in most examinations. Some of these could not be answered if the candidate had unlimited time or could consult a library.

The protest must come from the profession, from those who face the ever-recurring emergencies of practice. With a human life at stake and no help available, how futile to recall the reactions of the gastrocnemius of *Batrachia*, the behavior of atmospheric gases, or the twenty separate processes for making pure potassium permanganate! These latter are taken from recent State board examinations. The candidate was asked to give in a time limit of eight minutes the processes for which the briefest description in the dispensatory employs five hundred words.

It is self-evident that if a lifetime is too brief to master medical science, a competent adjustment cannot be made by simply lengthening

the present course of study. The adjustment must be made by reforming the course. Its waste of words and methods, its oratory and rhetoric must be eliminated from lectures and text-books and its numerous aliases consigned to the graveyard. Let us build monuments to our medical discoverers instead of perpetuating their names by inflicting a freak terminology upon the student.

The mental attitude inculcated by seriate teaching is that man is an assemblage of parts that can be surveyed piecemeal. The student is educated by various specialists as a regional physician, and he goes into practice as a collective specialist. His diagnosis is synthetic, rather than analytic. An author has pertinently said that our best students often forget the diagnostic signs of disease because they have not been given a thinking basis for correlating them to pathology. Frequently the foundation crumbles before the superstructure of a medical education is superimposed thereon (Hiram Woods).

The conclusion, therefore, is inevitable that the sum total of a medical education acquired serially from an aggregation of specialists does not constitute an adequate training for the medical profession, and that the entire system demands revision.

The medical curriculum is not well considered nor well presented. Forty per cent. of the work now done could be eliminated without invading the field of the essential. Anatomy and physiology should be taught *pari passu* with pathology, thus making the student's knowledge secure at all stages of his career. The laboratory and clinic should be brought into more intimate relationship for the same reason.

There is a crying need for coördination, for a systematic blending and sequence of studies. All experimental and auxiliary work of the nature of formal training and all preparatory work should be abandoned.

Until medical colleges cease simply to promulgate nondescript medical knowledge and until they produce efficient workers for the social fabric of the nation, they will have failed to fulfil their high destiny in the sphere of human evolution.

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